U. S. Government

RESEARCH REPORTS

May 15, 1959
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OFFICE OF TECHNICAL SERVICES

Vol. 31, No. 5 Pp. 285-386 May 15, 1959

AGRICULTURE

Princeton U., N. J.
LATERAL EARTH PRESSURES AT REST, by Werner E. Schmidt, Donald L. York, and Gerald P. Raymond. Progress rept. on Contract Nonr-1009(00). Aug 57, 130p. 20 refs.
Order from LC mi$6.30, ph$19.80 PB 135 737

Triaxial cell test C-17 on an undisturbed specimen of stiff chicago clay, by Donald L. York
Triaxial cell tests C-20, C-21, C-22 on remolded specimens of princeton red clay, by Gerald P. Raymond

American Inst. of Crop Ecology, Washington, D. C.
BACKGROUND STUDY OF BURMA: A REVIEW OF ITS PHYSICAL ENVIRONMENT, FLORA AND AGRICULTURE. Rept. on Contract DA 18-064-404-cml-68. Dec 55. 169p. 92 refs.
Order from LC mi$7.80, ph$25.80 PB 138 955

Contents:
General and comparative geography
Climate of Burma
Natural vegetation of Burma
Natural regions of Burma
Soils of Burma
Agriculture of Burma as related to its ecological background
Farm crops--distribution, production, varieties and phenology
General field practices--crop rotations, application of fertilizers, and control of diseases and pests
Agriculture in relation to food problems, and the food potential of Burma

ASTRONOMY

Astrophysics

Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.
SILICATE METEORITE STRUCTURES AND THE ORIGIN OF THE METEORITES, by John A. Wood, Jr. Technical rept. no. 10 on Contract AF 18(600)1596. 19 June 58, 172p. 49 refs. AFOSR TN-58-547; AD-158 364.
Order from LC mi$8.10, ph$27.30 PB 136 268

Petrography (particularly textures) and petrology of stony meteorites. Some chondrites are analogous to sedimentary rocks, others to metasediments. The possibility that the non-chondrites are the product of re-melting of the core of a parent meteorite planet is explored.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
STUDY OF CO_2 ABSORPTION SPECTRA BETWEEN 15 AND 18 MICRONS, by Robert P. Madden. Rept. on Contract Nonr-248(01). Feb 57, 111p. 37 refs.
Order from LC mi$6.00, ph$18.30 PB 135 524

Ohio State U. Research Foundation, Columbus.
NEAR INFRARED SPECTRUM OF MARS, by J. H. Shaw, D. E. Burch, and H. Z. Cummins. Scientific rept. 8 on Contract AF 19(604)1003. Nov 57, 21p. 8 refs. AFCRC TN-58-203; AD-146 791.
Order from LC mi$2.70, ph$4.80 PB 136 405

Infrared spectra of Mars were obtained in the autumn of 1956. From the intensity of the CO_2 bands near 1.6 μ it has been estimated that the amount of CO_2 in the atmosphere of Mars is about four times greater than in the earth's atmosphere if the surface pressure is 100 mb and the atmosphere is mostly composed of nitrogen. This is compared with a Martian CO_2 abundance of 13 ± 4 times that of the earth's atmosphere obtained by Grandjean and Goody (Astrophys. J. 121:548, 1955) from the data of G. P. Kuiper (Atmospheres of Earth and Planets, 2nd edition, Chicago, 1952). No evidence of bands of CO(2.35 μ) or N_2O (2.11, 2.26 and 3.9 μ) was found, and upper limits of 50 atmo-cm have been placed on these gases. On one spectrum indications of an absorption at 3.5 μ were obtained, in agreement with the results of Sinton (to be published in Astrophys. J.) However, the detector failed before confirmatory spectra could be obtained.

School of Aviation Medicine, Randolph AFB, Tex.
STUDY ON SUBGRAVITY STATES, by Fritz Haber. Apr 52, 11p. 4 refs. Proj. 21-34-003, Rept. no. 1; ATI-152 957.
Order from LC mi$2.40, ph$3.30 PB 137 131

The equations of motion of a body under subgravity conditions are discussed. The applications to an elevator and airplane are explained and the obtainable duration of subgravity and zerogravity calculated. The short period of time available in elevators does not warrant the use of this means. An airplane with an initial speed of 450 m.p.h. makes it possible to maintain zerogravity for 35 seconds.

BEHAVIORAL SCIENCES

Human Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SIMPLE REACTION TIME, A REVIEW WITH REFERENCE TO AIR FORCE EQUIPMENT, by Warren H. Teichner. Aug 52, 31p. Technical note WCRD 52-47; ATI 204 151.
Order from LC mi$3.00, ph$6.30 PB 138 331

Certain widely accepted generalizations about the simple reaction time are critically reviewed in terms of the experimental studies on which they are based and are related to problems of Air Force equipment design. It is the author's opinion that many of these generalizations have not been sufficiently demonstrated and must, therefore, be considered as hypotheses rather than fact. Working hypotheses as to the factors which influence the reaction time and the manner in which they do so are formulated as an aid to the research worker and to the consulting human engineer.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
SOME PERCEPTUAL FACTORS INVOLVED IN THE DESIGN OF OBSTACLE WARNING DISPLAYS FOR AIRCRAFT, by James M. Vanderplas. Rept. on Presentation of Data on Radar Scopes. Mar 54, 16p. 8 refs. Technical note WCRD TN-54-9; AD-65 872.
Order from LC mi$2.40, ph$3.30 PB 137 968

This report constitutes a discussion of some perceptual problems involved in visually presenting information for spatial and geographic orientation of the pilot in flight and in the design of an aircraft display for obstacle warning. A summary is presented of general principles of visual preception of space, along with a discussion of how these principles may be applied in several representative designs of a pictorial or symbolic display for geographic orientation and obstacle warning. Several types of displays, both pictorial and symbolic, are discussed as examples of application of the principles, and suggestions are presented for their application to an obstacle warning display method.

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
EVALUATION OF RADAR SYMBOLS FOR TARGET IDENTIFICATION, by Joseph F. Dardano and Ray Donley. Mar 58, 28p. 13 refs. Technical memo. no. 2-58.
Order from LC mi$2.70, ph$4.80 PB 135 343

Five geometric forms considered for use as radar symbols were compared for discriminability. Frequency of symbols on the screen and proportion of the discriminated symbol to other symbols on the display were included as independent variables.

Army Ordnance Human Engineering Lab., Aberdeen Proving Ground, Md.
INVESTIGATION OF SYMBOL MEANING COMBINATIONS FOR USE IN RADAR DISPLAYS, by James P. Torre Jr. and Leonard A. Sanders. Mar 58, 21p. Technical memo. no. 1-58.
Order from LC mi$2.70, ph$4.80 PB 135 344

This report covers the attempts to derive a set of symbol forms which could be used to designate "enemy", "friendly" and "unknown" targets on a radar scope.

Dunlap and Associates, Inc., Stamford, Conn.
HUMAN ENGINEERING REVIEW OF THE TACTICAL AIR CONTROL PARTY COMMUNICATIONS VEHICLE AN/MRC-43, by John D. Coakley and Joseph T. Fucigna. Preliminary rept. on Contract AF 30(602)215. Oct 53, declassified 5 Nov 53, 12p. [RADC TN-54-45]
Order from LC mi$2.40, ph$3.30 PB 137 463

The specifications for the AN/MRC-43 state that presently available communications equipment must be utilized and that modifications or redesign of the equipment components is not permitted. Accordingly, a recommended arrangement of the presently available control components is presented. However, any arrangement of these components involves certain undesirable features. Consequently a design is presented which avoids the difficulties but requires some modification of the control units only. This arrangement should be adopted provided modification of these units is permissable.

Psychological Corp., New York.
USE OF HUMAN ENGINEERING DATA IN EQUIPMENT DESIGN PROBLEMS, by Ralph C. Channell and Martin A. Tolcott. Rept on Proj. Therblig, Contract N6ori-151. 20 May 48, 35p. 31 refs. Rept. 151-1-16; ATI-26 586.
Order from LC mi$3.00, ph$6.30 PB 137 384

The purpose of this report is to cite examples of design problems which are typical of those encountered in consulting work. The manner in which recommendations are derived by reconciling pertinent experimental data with the specific requirements of the equipment will be discussed. The cases cited will illustrate the various degrees of confidence with which recommendations are made, and will point up the areas in which further research is needed. The examples are gathered from studies of equipment designed for use aboard submarines. However, the problems encountered and the method of approach are probably typical of large areas in the field of applied human engineering.

Personnel and Training

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
ON-THE-JOB TRAINING AND PROFICIENCY OF K-SYSTEM MECHANICS, by John T. Larkins and Donald S. Jewell. Final rept. on Principles of Effective OJT for Armament Maintenance. Jan 58, 24p. 17 refs. AFPTRC TR-58-5; AD-152 107.
Order from LC mi$2.70, ph$4.80 PB 136 033

Research and development studies conducted in the maintenance personnel and training field are described, specifically in the areas of proficiency and performance evaluation of flight-line maintenance personnel for bombing-navigational systems and methods for the improvement of on-the-job training for these personnel. Tests, paper-and-pencil trainers, trainers, and job aids experimentally developed and evaluated under this task are briefly described. These include: K-System MAC-1 Trainer MAC-2 Trainer, GETS Trainer, The Trainer - Tester, Malfunction - Information Trainer, and Trouble Locator.

American Inst. for Research, Pittsburgh, Pa.
HUMAN FACTOR IN ACCIDENTS WITH SPECIAL REFERENCE TO AIRCRAFT ACCIDENTS, by Robert L. Thorndike. Feb 51, declassified 18 June 56. 184p. 209 refs. AFSAM proj. no. 21-30-001, rept. no. 1; ATI-102 123.
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Contents:
The nature and background of the problem of aircraft accidents
The reporting and coding of accidents
Accident-proneness
Prediction of accident-proneness by measures of the individual worker
Acidents as related to temporary attributes of the individual
Accidents in relation to training and experience
Accidents as a function of operating procedures
Situational factors in accident causation

American Inst. for Research [Pittsburgh, Pa]
A STUDY OF NON-INTELLECTUAL CORRELATES OF TROUBLE-SHOOTING ABILITY: RIGIDITY MEASURES, by Murray Glanzer and Robert Glaser. Rept. on Contract AF 41(657)58. Oct 58, 37p. 27 refs. WADC Technical rept. 58-488; AD-204 511.
Order from OTS $1.00 PB 151 522

The main objective of this study was to determine the relationships of a number of proposed measures of problem-solving rigidity to performance on both novel and routine electronic trouble-shooting tasks. These relationships were selected because of their possible contribution to the prediction of trouble-shooting skills. If the relationships are high the rigidity measures could be valuable additions to standard aptitude tests used in the selection of personnel for technical training.

Highway Research Board, National Research Council, Washington, D. C.
HIGHWAY RIGHT-OF WAY PERSONNEL SALARIES: AN ECONOMIC ANALYSIS, by Edmond L. Kanwit, Paul M. Segal, and David R. Levin. 1958, 110p. 26 refs. Special rept. 34.
Order from NCR $2.80 NRC pub 604

It is impossible to build highways and other public improvement projects without the necessary property. Nevertheless, it is a complex and sometimes perplexing operation to obtain the needed lands or interests in land for such purposes. A qualified right-of-way agent, be he appraiser or negotiator, must be a person of extensive training and experience -- the possessor of many talents. Unfortunately, this fact is not fully recognized today. Accordingly, highway and public works officials are confronted with difficulties associated with right-of-way. No small part of such difficulties seems to be related, in part at least, to the lack of recognition of the important role played by the right-of-way officials and the resulting relative inadequacy of the compensation paid this group of employees.

Human Factors Research, Inc., Los Angeles, Calif.
FACTOR ANALYTIC STUDY OF APTITUDES, INTERESTS, AND PRACTICAL PERFORMANCE SKILLS OF NAVY MACHINERY REPAIRMAN STUDENTS, by Wallace S. High and Robert R. Mackie. Technical rept. 7 on Research on the Development of Performance Criteria, Contract Nonr-1241(00). June 57, 177p. 48 refs. AD-136 921.
Order from LC mi$8.10, ph$27.30 PB 138 967

This report describes the results of a factor analytic study to determine the factor content of sixty job sample performance measures and instructor rankings obtained from a sample of 200 Machinery Repairmen students at a Navy Class "A" trade school. The factorial nature of these measures is described in terms of their relationship to fifty-four well-known standard reference tests. Two analytic rotational methods (one oblique and one orthagonal) were used and evaluated in terms of the results obtained with each.

National Research Council, Washington, D. C.
DOCTORATE PRODUCTION IN UNITED STATES UNIVERSITIES 1936-1956 WITH BACCALAUREATE ORIGINS OF DOCTORATES IN SCIENCES, ARTS AND HUMANITIES, by M. H. Trytten and L. R. Harmon. 1958, 163p.
Order from NRC $2.00 NRC Pub. 582

Naval Personnel Research Field Activity, Washington, D. C.
CONSTRUCTION AND VALIDATION OF THE OFFICER CANDIDATE SELF-DESCRIPTION BLANK, by Francis E. Brodney. Sep 57, 21p. 8 refs. BuPers Technical Bulletin 57-9.
Order from LC mi$2.70, ph$4.80 PB 135 422

The purpose of this research is to add significantly to the predictive efficiency of the current battery for the selection of OCS applicants. The overall problem can be divided into three subproblems: (1) To determine the effectiveness of the current selection instruments in the prediction of final grade at the OCS. (2) To construct and validate an instrument which would provide an independent prediction of OCS performance. (3) To determine the effect of the addition of the new selection instrument to current selection variables in prediction of the final grade at OCS.

Personnel Lab., Lackland AFB, Tex.
PERCEPTUAL PERFORMANCE AND THE EFFECTIVE PERSON, by Richard S. Crutchfield, Donald G. Woodworth, and Ruth E. Albrecht (Institute of Personality Assessment and Research). Rept. on Contract AF 18(600)8. Apr 58, 92p. 11 refs. WADC TN-58-50; AD-151 039.
Order from LC mi$5.40, ph$15.30 PB 137 117

The Institute of Personality Assessment and Research carried out an extensive psychological assessment of a group of 100 Air Force captains in order to develop a set of procedures which would identify those officers most likely to be effective in command and staff positions. This particular study presents data collected from 10 perceptual tests included in the program. Developmental material is presented for some of the tests. The purpose of this report is to show the potential contribution of such perceptual behavior to the assessment and understanding of personality. Stress is upon the perceptual performance of the military officer rated effective. Results indicate that the perceptual tests are most strongly related to the areas of intellect and cognitive flexibility. Numerous significant relationships were found with tests in the areas of emotional adjustment, social relations, and leadership. The specific nature and direction of the relationships between perceptual and personality measures are consistent with the assuption that basic personality trends are general in nature and should manifest themselves in analogous ways in perceptual and other forms of behavior.

School of Aviation Medicine, Randolph AFB, Tex.
THE AIR FORCE HEARING CONSERVATION PROGRAM, by Ralph N. Kraus. Sep 57, 12p. Aeromedical Reviews no. 3-58.
Order from LC mi$2.40, ph$3.30 PB 137 572

This paper describes how the United States Air Force has implemented this program.

School of Aviation Medicine, Randolph AFB, Tex.
HISTORICAL REVIEW OF AIRCREW SELECTION: DEVELOPMENT OF PSYCHOLOGIC SELECTION OF PILOTS IN THE UNITED STATES AIR FORCE AND PREDECESSOR ORGANIZATION IN THE UNITED STATES ARMY, by Robert R. Burwell. Sep 57, 25p. 25 refs. Aeromedical reviews no. 1-58.
Order from LC mi$2.40, ph$3.30 PB 135 491

This paper will present an historical review of the research and development of psychologic selection methods in the United States Air Force and its predecessor Army organizations, with particular reference to pilot selection. The psychologic qualifications required of pilot candidates are no less important and the present aptitude examinations are no less rigorous or thorough than the medical. This review covers the period from the beginning of powered flight to the present.

School of Aviation Medicine, Randolph [AFB] Tex.
LEG STRENGTH AND LEG ENDURANCE IN RELATION TO HEIGHT, WEIGHT AND OTHER BODY MEASUREMENTS, by Edwin R. Elbel. 15 Aug 45, 30p. Proj. no. 318, rept. no. 1; AD-44 548.
Order from LC mi$2.70, ph$4.80 PB 138 463

This study was conducted in an attempt to determine whether the height and weight standards, used in the selection of pilots for heavy bombers, could be reduced without correspondingly reducing leg strength and leg endurance. During certain conditions in the flight of heavy aircraft and particularly during the abnormal conditions caused by various types of mechanical failure, the leg strength and leg endurance of the pilot are considered of vital importance. Methods of measuring leg strength and leg endurance were developed during this study. In addition to these, certain other measurements, considered to have a bearing upon the selection of pilots for heavy aircraft, were included in order to determine whether they would be of value in predicting leg strength and leg endurance.

School of Aviation Medicine, Randolph [AFB] Tex.
PROCEDURE IN NOISE AUDIOMETRY, by Juergen Tonndorf and F. A. Brogan. Mar 52, 13p. 13 refs. Proj. no. 21-27-001, rept. no. 3.
Order from LC mi$2.40, ph$3.30 PB 135 463

Psychology

Adjutant General's Office, Washington, D. C.
CONCEPTUAL CONSISTENCY AND CRITERION EQUIVALENCE: A DUAL APPROACH TO CRITERION ANALYSIS, by Richard H. Gaylord. June 53, 10p. 5 refs. PRB Research note 17.
Order from LC mi$1.80, ph$1.80 PB 138 281

It is suggested in this Research Note that the nature of a criterion can be established by examining its relation with other variables. A criterion measure may be regarded as adequate if it is related to other variables in a manner consistent with the concept of what constitutes good and poor performance. A second approach to criterion analysis, called criterion equivalence, is discussed. In this, two or more criteria may be regarded as equivalent if it can be shown that the same battery of tests would be selected regardless of which criterion was used.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
VERBALLY MEDIATED TRANSFER AS A FUNCTION OF ORDER TASKA, by John M. Newton, Ross L. Morgan, and others. Rept. on Learning and Transfer in Reference to Training Device Design, Contract AF 18(600)78. Feb 54, 24p. 8 refs. WADC Technical rept. 54-41; AD-33 353.
Order from LC mi$2.70, ph$4.80 PB 139 051

The present study was designed to investigate one set of conditions (order of training tasks) affecting the occurrence of transfer of training resulting from a "learned" equivalence between pairs of stimuli in two tasks. Eight groups of subjects, four "experimental" (E) and four "control" (C), received practice on three training tasks prior to being tested on the same final task. The training tasks were identical for all E groups, but the order in which they were experienced differed. Four orders of tasks were studied -- positive transfer was predicted for two of the orders (E_1 and E_3), while zero transfer was predicted for the other two (E_2 and E_4). When tested on the final task, significant amounts of positive transfer were displayed by E_1, E_2, and E_3, and "zero" transfer by E_4. An attempt was made to reconcile the results with Hull's theory of "mediated stimulus equivalence" by invoking a seemingly reasonable relationship between level of learning and "real" order of tasks.

Air Force Personnel and Training Research Center, Lackland AFB, Tex.
PSYCHOLOGICAL STUDIES OF THE CONTENT AND METHODS OF PRESENTING CHARTS AND MAPS FOR RADAR OBSERVERS AND NAVIGATORS, by William H. Lichte. Rept. on U. of Missouri, Contract AF 18(600)1209. Jan 58, 27p. 4 refs. AFPTRC TR-58-3; AD-152 105.
Order from LC mi$2.70, ph$4.80 PB 135 922

The pilot studies and experiments summarized in this report were undertaken (a) to provide additional insights into the types of information derived from radarscope displays, (b) to develop an objective test of navigator performance, and (c) to study the influence of certain chart variables on performance. Two techniques for measuring performance were developed: a group form of the "pinpoint" technique of aiming-point identification and the new "city recognition test," a group method based on use of slides and a projector. Major emphasis was placed on the study of the effects of two chart variables, namely, map scales and amount of information. Basic students and experienced navigators served as experimental subjects.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
EFFECT OF PAIN ON SIMULTANEOUS PERCEPTION OF NON-PAINFUL SENSORY STIMULATION, by F. B. Benjamin. 12 July 55, 22p. 18 refs. Rept. no. NADC-MA-5506; Proj. NM 001 103 301, Rept. no. 5.
Order from LC mi$2.70, ph$4.80 PB 137 105

Pain is shown to be associated with a lowering of the perception of simultaneous non-painful sensory stimuli. The degree of interference is found to increase in proportion to the pain intensity at the time of testing. However, this pain intensity at the time of testing may be modified by the relative attention to the painful and the non-painful stimulation.

Connecticut Coll., New London.
EFFECTS OF AN INTERFERING TASK ON THE LEARNING OF A COMPLEX MOTOR SKILL (HUMAN ENGINEERING SYNTHESIS OF BASIC INFORMATION) by Robert M. Gagne, Katherine E. Baker, and Ruth C. Wylie. Rept. on Contract N7onr-316 (01). 12 Aug 49, 28p. 3 refs. Technical rept. SDC 316-1-9; ATI-206 035.
Order from LC mi$2.70, ph$4.80 PB 138 492

An experiment is reported which deals with the effects of introducing an interfering task at various stages during the learning of a motor skill. The motor skill used here was the Complex Coordination Test, which requires the subject to make alignments of three sets of red and green lights by movement of a stick and rudder which resemble the controls of an airplane. The Interfering Task consisted of appropriate forward and backward movements of a gear shift arrangement at the subject's left in response to the appearance of a red or green light on the extreme left side of the Complex Coordinator panel. The experiment involved six groups of 22 college men, matched as to the time required to make the first eight Complex Coordinator settings. The learning was divided into six stages of 26 trials each, and the Interfering Task was introduced at different stages for the different groups. One group had the Interfering Task from Stage 1 onward, another from Stage 2 onward, etc. The performance of the Complex Coordination Task with and without the Interfering Task was measured in terms of the time required for making 26 settings at each learning stage.

Connecticut U., Storrs.
KW MEMORY FOR NAMES AND FACES TEST, by Sam L. Witryol, Walter A. Kaess, and Joseph J. Danick. Technical rept. 3 (Manual) on Contract Nonr-1886(00). Sep 57, 22p. 8 refs.
Order from LC mi$2.70, ph$4.80 PB 135 890

The purpose of this picture memory test is to detect individual differences in the ability to identify, recall, and recognize other people. This performance test is intended to reflect social alertness and orientation. Report divided into 8 parts as follows: Nature of the KW Test; Description of the Test; Steps in Administering the Test; Scoring Procedure; Norms, Sex Differences, and Other Statistical Data; Reliability; Validity; and Interpretation.

Goodyear Aircraft Corp., Akron, Ohio
FLIGHT CONTROLS, HUMAN DYNAMIC RESPONSE STUDY, Final rept. on Investigation of Vestibular and Body Reactions to the Dynamic Response of a Human Operator, Contract NOa(s) 53-013-c. Nov 53, 26p. 3 refs. GER-5452; BuAer rept. AE-61-6; Supplement to BuAer rept. AE-61-4III.
Order from LC mi$2.70, ph$4.80 PB 137 251

This final report describes the construction and use of a movable cockpit capable of providing realistic simulation of aircraft movements in addition to the usual visual display. A major portion of this report describes the design features of the apparatus. Some characteristic data are also given, and tests of a simple, linear approximation of pilot dynamics are discussed.

Illinois U. Coll. of Education, Urbana.
CORRECTION AND EXTENSION OF THE RELATIONSHIP OF INTERPERSONAL PERCEPTION TO EFFECTIVENESS IN BASKETBALL TEAMS, by Fred E. Fiedler, Walter Hartmann, and Stanley A. Rudin. Supplement to Tech. rept. no. 3 on Social Perception and Group Effectiveness, Contract N6ori-071(35). Feb 53, 10p. 1 ref. AD-6563.
Order from LC mi$1.80, ph$1.80 PB 136 228

Interpersonal perception was measured by means of Assumed Similarity (AS) scores. Fourteen high school basketball teams were tested at the beginning of the 1951 season. Two promising relations found in this exploratory study involved the scores ASp, Assumed Similarity to the preferred work-companion and ASo, Assumed Similarity between the opposites (i.e., between the most and the least preferred work-companions).

Iowa State Coll., Ames.
CONSTRUCTION OF A FORCED-CHOICE "COOPERATION" TEST AND INVESTIGATION OF MATCHING INDICES OF POTENTIAL VALUE TO FORCED-CHOICE QUESTIONNAIRES, by Howard Maher. Rept. on Contract N6onr-371(03) [1958] 33p. 13 refs.
Order from LC mi$3.00, ph$6.30 PB 136 123

An attempt has been made to construct a forced-choice test measuring in an ordinary day-by-day behavior area, in this case "Cooperation." A large group of students provided examples of important behavior, selected the "traits" of most importance to them, and provided the items. These were edited by a number of judges and the surviving 336 items were submitted to 150 fraternity men who provided, through their ratings of the items, preference and discrimination values. As a corollary problem, we have investigated the relationships among a number of matching indices. Fraternity men were first asked to "beat" a forced-choice scale. From interview responses, "beating" hypotheses were established. In turn, these were converted to 11 self-description scales. Mean items responses on these scales and preference and discrimination indices were intercorrelated. The resulting matrix was factor analyzed. It was possible to isolate a rather general factor (Social Desirability), lending support to the work of Gordon. Four other, lesser, factors were also found. From this work it would appear at least possible to match forced-choice alternatives on a single appearance index, with some assurance that other possible appearances will also be controlled.

Johns Hopkins U., Baltimore, Md.
COMPLEXITY OF CONTOUR IN THE RECOGNITION OF VISUAL FORM, by James Deese. Rept. on Contract AF 33(038)22642. Feb 56, 26p. 9 refs. WADC Technical rept. 56-60.
Order from LC mi$2.70, ph$4.80 PB 139 046

The results showed that, for forms made of abrupt, right-angled changes in contour, complex forms (those with many changes in the contour) are more accurately identified in an immediate recognition test than simple forms, if the observers are required to remember only one form at a time. If observers are required to remember 10 or 25 forms for recognition, simple forms are more accurately identified than complex forms. For forms with abrupt, varied-angled changes in contour, there is no difference in accuracy of recognition between simple and complex contours. This lack of a difference between simple and complex contours for these forms is associated with a high incidence of reported verbal labelling or naming of the forms. This suggests that if observers can verbally code the forms, the relationships between complexity and recognition disappear. These findings led the author to the conclusion that forms which present relatively large amounts of information are more discriminable (unique), and are therefore easier to identify, but because they contain more information, they are harder to remember. If the observer is able to code forms with previously stored information, the information conveyed in the form may make little difference in a test of recognition. Thus, any attempt to reduce the information content of contours in order to facilitate memory for them may run into difficulty because of reduced discriminability among the forms. If the forms can be coded in terms of previously acquired information, however, both discrimination and retention may be facilitated.

Louisville U., Ky.
KNOWLEDGE OF PERFORMANCE, by Robert B. AMMONS. Report on Learning and Transfer in Reference to Training Device Design, Contract AF 33(616)95. Feb 54, 37p. 58 refs. WADC Technical rept. 54-14; AD-34 643.
Order from LC mi$3.00, ph$6.30 PB 137 882

This report represents a systematization of much of the currently available information concerning the influence of knowledge of performance on learning, performance and transfer of training. The results of a large number of studies are organized into eleven "empirical generalizations." Some possible applications of the generalizations to the design of training equipment are discussed and needed research studies, ranging from specific experiments to needed area programs, are indicated.

Office of Naval Research, Washington, D. C.
BIBLIOGRAPHY OF UNCLASSIFIED RESEARCH REPORTS IN GROUP PSYCHOLOGY. Sep 57, 45p.

810 refs. ONR rept. ACR-22.
Order from LC mi$3.30, ph$7.80 PB 136 278

This Bibliography lists the technical reports submitted to the Office of Naval Research in the field of group psychology as of 1 January, 1957.

Radiobiological Lab., U. of Texas, Austin.
EFFECT OF VISUALLY HOMOGENEOUS STIMULUS OBJECTS ON MANIPULATORY BEHAVIOR, by Richard M. Carr and W. Lynn Brown. July 58, 4p. 6 refs. AFSAM rept. 58-92.
Order from LC mi$1.80, ph$1.80 PB 138 119

Ten experimentally naive male monkeys were tested on a special manipulation box for 10 minutes each day for 5 days on each of five different stimulus objects of the same size, shape, color, and weight. The objects were made of wood, metal, cork, rubber, and plastic. The results demonstrate that monkeys, when presented with sets of visually homogeneous stimulus objects, no longer show a preference for any particular set of objects and that manipulation will continue to increase over a period of four weeks and then rapidly decline.

San Diego State Coll., Calif.
BIBLIOGRAPHY; COMPARISON AND INTERACTION AMONG SENSORY INPUT CHANNELS. Rept. on Contract Nonr-1268(01). 1 Mar 55, 18p. 245 refs. AD-95 131.
Order from LC mi$2.40, ph$3.30 PB 138 278

School of Aviation Medicine, Randolph AFB, Tex.
AN ACQUIESCENCE KEY FOR THE MMPI, by Samuel C. Fulkerson. July 58, 12p. 17 refs. Rept. 58-71.
Order from LC mi$2.40, ph$3.30 PB 136 856

A 24-item Acquiescence Key, designed to measure an individual's tendency to agree with a statement irrespective of content, was constructed from the MMPI (Minnesota Multiphasic Personality Inventory). This key was combined with a 142-item Adjustment Key, also from the MMPI, to predict a criterion of adjustment. The combination correlated significantly higher with the criterion than the Adjustment Key alone, with acquiescence acting as a suppressor variable. There was also a tendency for the validity of the Adjustment Key to be greatest for those subjects with an average score on the Acquiescence Key.

School of Aviation Medicine, Randolph AFB, Tex.
HUMAN FLIGHT BEHAVIOR IN GROUPS, by S. B. Sells. July 58, 22p. 41 refs. Aeromedical Reviews no. 6-58.
Order from LC mi$2.70, ph$4.80 PB 136 773

This paper has presented a survey of research on group behavior oriented to problems of aircrew proficiency. A common semantic problem was clarified which involves the distinction between terms descriptive of behavior and those descriptive of group functioning. Group performance depends both on staffing and utilization of personnel. Staffing refers to capabilities of group members. Utilization refers to the work environment provided by management for the group. Approaches to utilization considered were the structural approach, group dynamics, and the group as a man-machine system.

School of Aviation Medicine, Randolph AFB, Tex.
MEDICAL ASPECTS OF FLYING MOTIVATION: A FEAR-OF-FLYING CASE BOOK, by Charles A. Sarnoff. Oct 57, 181p.
Order from LC mi$8.40, ph$28.80 PB 137 521

The purpose of this book is to give the flight surgeon a working knowledge of the many facets of aviation medicine in which flying motivation plays a part. Over fifty full case reports are presented to supplement the flight surgeon's own experience. The proper handling of cases from the standpoint of Air Force regulations and medical indications is discussed; and a system for categorizing patients is offered. Interpretations of the cases are not "deep." They are aimed at a level beyond which no one should interpret with the limited amount of time for interview and investigation at the disposal of the flight surgeon.

BIOLOGICAL SCIENCES

National Research Council, Washington, D. C.
BIOLOGICAL EDUCATION; A PARTIAL BIBLIOGRAPHY. July 57, 165p. 3400 refs.
Order from NRC $3.00 NRC pub. 518

Texas U., Austin.
CHEMICAL FACTORS IN CULTURE MEDIA WHICH INFLUENCE BACTERIAL GROWTH INITIATION, by Charles E. Lankford, T. P. Sergeant (Trinity U.) and others. Aug 58, 14p. 7 refs. AFSAM rept. 58-86.
Order from LC mi$2.40, ph$3.30 PB 137 879

Various inhibitory and stimulatory factors for the initiation of bacterial cell division were found after heat sterilization of bacteriologic culture media. An inhibitory factor was found in certain lots of commercial peptones; another (for certain organisms) was produced by the interaction of glucose and phosphate; others resulted from the interaction of tyrosine, tryptophane, and/or alanine. A stimulatory factor resulted from the interaction of glucose and phosphate, and from the growth of the test organisms. Certain of the more important factors were highly concentrated or partially purified, their chemical identities or properties noted, and hypotheses for their formation and for their mode of action formulated.

Washington U., St. Louis, Mo. School of Medicine.
ETHER-SOLUBLE SUBSTANCES ON THE SKIN OF THE HUMAN EXTERNAL AUDITORY CANAL, by S. P. Chiang, C. F. Gessert, O. H. Lowry, and others. June 57, 7p. 23 refs. AFSAM rept. 56-114.
Order from LC mi$1.80, ph$1.80 PB 136 857

Measurements were made of the ether-soluble substances (ESS) obtained from the normal external ear canal before and at intervals after cleaning. Although a wide range in the amounts of ESS was found among subjects in both casual and fresh specimens, there was a high correlation between the right and left ears with respect to the fresh lipid secreted. Average daily replacements tended to be higher when the collections were more frequent and to be constant when the intervals between successive collections were equal. The percentages of cholesterol in ESS were significantly lower in fresh specimens than in casual.

Anatomy and Physiology

Chicago U., Ill.
MODIFICATIONS OF COCHLEAR RESPONSES BY OXYGEN DEPRIVATION, by César Fernández and Rene Alzate. June 58, 19p. 17 refs. AFSAM rept. 58-101.
Order from LC mi$2.40, ph$3.30 PB 137 204

Survival of guinea pigs, behavior of cochlear responses, and histology of the inner ear were observed under several conditions of oxygen deprivation. Anesthesia with dial in urethane diminished considerably the survival time of guinea pigs; this observation indicates that this drug acts as a depressor of the respiratory center. The dependence of cochlear responses on the oxidative reactions was demonstrated. Neural components were more sensitive to oxygen deprivation than were cochlear microphonics. Depression of these potentials seemed to be related to those chemical reactions which underlie the generation of energy. Routine histologic methods (hematoxylin-eosin and light microscopy) seemed to be inadequate for detecting changes in the inner ear structures of animals with apparent permanent depression of cochlear responses induced by repeated exposures to asphyxia. Chronic experiments suggested that this depression was a reversible phenomenon.

Chicago U., Ill.
POSTMORTEM CHANGES AND ARTIFACTS IN HUMAN TEMPORAL BONES, by Cesar Fernández. May 58, 24p. 17 refs. AFSAM rept. 58-87.
Order from LC mi$2.70, ph$4.80 PB 138 118

In a study on preservation of human temporal bones from postmortem changes and artifacts, three procedures were compared: removal of the stapes before immersion, immersion, and injection of formalin into the middle ear soon after death. The results were classified as good, fair, poor, or unsatisfactory according to the preservation of fine cellular details. Removal of stapes did not give better results than the other procedures and it was not suitable for middle ear histologic studies. Injection of formalin into the middle ear soon after death gave a higher proportion of good results than the immersion procedure. Fair and poor results were mainly due to postmortem changes (swelling, homogenization and pyknosis of cells, precipitates, and globular formation). Unsatisfactory results due to compression phenomenon were observed in about half of the specimens.

Göttingen U. (West Germany).
PHYSIOLOGICAL RESEARCH USING KRAMER OXIMETER, by Kurt Kramer. Final rept. on Contract AF 61(514)901. 8 Jan 57, 15p. 5 refs. AFOSR TR-57-19; AD-120 458.
Order from LC mi$2.40, ph$3.30 PB 138 690

A whole blood colorimeter for continuous recording of an infrared absorbing dye at the infrared isosbestic point of Hemoglobin (805 m/u) has been constructed. It has the advantage over other methods using dyes such as Evans Blue, indigo carmin, that errors due to O_2-saturation changes are avoided. Arterial dye concentration curves are presented after injections of 1 - 2 mg of the new substance. The dye, being a derivative of cyanine, is nontoxic in doses 10 times as high as used in an actual experiment. Controls of cardiac output in dogs with the rotameter have furnished comparable results. Mean deviation at normal range of c. o. amounts to ± 5 %.

Indiana U., Bloomington.
RESONANCE IN THE HUMAN OPERATOR, by Douglas G. Ellson and Lon Wheeler, Jr. Rept. on Contract W33-038-ac-13968. Apr 51, 37p. 8 refs. AF Technical rept. no. 5834; ATI-157 967.
Order from LC mi$3.00, ph$6.30 PB 135 453

In an effort to determine whether there is a resonance phenomenon in human operators during a sinusoidal tracking task, the linear components of sine wave trains of varying frequencies were presented as horizontal pointer movements to twenty-two subjects. The muscle action potentials from the main muscle groups involved in the tracking task and the actual tracking movements of the subjects were recorded.

Institute for Applied Experimental Psychology, Tufts U., Medford, Mass.
AGE AND FORM PERCEPTION, by Mason N. Crook, Edith A. Alexander, and others. June 58, 60p. 5 refs. AFSAM rept. 57-124.
Order from LC mi$3.90, ph$10.80 PB 136 774

The effect of age from 20 to 50 on ability to recognize visual forms was experimentally investigated with a variety of materials and testing arrangements. With optimum viewing conditions and long exposure time little or no age effect was found. With short exposures, reduced contrast, and overlays of visual noise, age effects appeared and increased in amount as conditions became more severe. Reduction of luminance produced a marked age effect which seemed very closely related to the physiologic age changes of the human eye.

Institute of Andean Biology, Lima (Peru).
ELECTROCARDIOGRAPHIC CHANGES OBSERVED DURING THE FIRST MONTH OF RESIDENCE AT HIGH ALTITUDE, by Dante Peñaloza. Aug 58, 9p. 16 refs. AFSAM rept. 58-90.
Order from LC mi$1.80, ph$1.80 PB 137 928

Electrocardiographic observations were made of subjects taken from sea level to high altitude where

they remained 16 to 30 days. The first changes were observed a few hours after arrival at altitude and the modifications were evident some days later. The changes disappeared 1 to 2 weeks after the subjects returned to sea level. The following changes were observed: (1) variations of the $\hat{A}P$ vector, which are probably related to wandering pacemaker in the sinus node; (2) changes of the QRS complex which are explained by variations in the cardiac position; and (3) modifications of the ventricular recovery process, which are probably related to subacute overloading of the right ventricle and right ventricular ischemia, as a consequence of the modifications of the pulmonary circulation in an environment of hypoxic hypoxia.

Naval School of Aviation Medicine, Pensacola, Fla.
EFFECT OF LINEAR ACCELERATION ON THE OCULOGYRAL ILLUSION, by Ashton Graybiel, J. I. Niven, and Kenneth MacCorquodale. 13 July 56, 25p. 19 refs. Proj. NM 001 110 100, R-42.
Order from LC mi$2.70, ph$4.80 PB 136 718

Experiments were performed on five healthy persons during which the angular acceleration was kept constant but the linear acceleration was varied by having the subject seated either near the center of rotation or 17 feet from the center. The oculogyral illusion was used as the indicator of stimulation of the semicircular canals in all of the experiments. Linear acceleration of small magnitude (angle $\emptyset$ up to 20^{O}) did not affect the illusion. The use of greater linear accelerations was complicated by associated illusory phenomena.

School of Aviation Medicine, Randolph [AFB] Tex.
COMBINED EFFECT OF NOISE AND HYPOXIA UPON THE AUDITORY THRESHOLD, by Juergen Tonndorf. Mar 53, 12p. 17 refs. Proj. no. 21-1203-0001, rept no. 1.
Order from LC mi$2.40, ph$3.30 PB 135 469

Laboratory experiments on human subjects were carried out in order to determine the combined effect, during and after stimulation, of noise and hypoxia upon the auditory threshold. Hypoxia was found to enhance the effect of noise as to masking, auditory fatigue, and the overshooting aftereffect frequently observed during the period of restitution. The fact that variations in oxygen supply affect the masking threshold, while additional peripheral impairment (auditory fatigue) fails to do so, indicates that hypoxia acts upon the auditory system at a level centrally in relation to the cochlea. This central effect of variation in oxygen supply may completely mask a similar, but weaker peripheral effect. In all cases of peripheral impairment (conductive and perceptive), the individual masking curve was found to join the normal curve at high levels of noise. Failure to do so was described as incomplete recession. This phenomenon is now explained to indicate true nerve-type hearing impairment.

University Coll. of the West Indies, Jamaica (B. W. I.)
ELECTROLYTE CHANGES DURING ACCLIMATIZATION TO HIGH ALTITUDE: OBSERVATIONS MADE ON THE BRITISH EXPEDITION TO THE COLOMBIAN ANDES, JANUARY 1957, by J. C. Waterlow and H. W. Bunjé. Aug 58, 16p. 32 refs. AFSAM rept. 58-79.
Order from LC mi$2.40, ph$3.30 PB 137 927

Whymper correctly divided the symptoms into two groups, permanent and transitory. The permanent effects are respiratory distress and a decreased capacity for muscular work. The transitory effects, which usually pass off in a few days, are severe headache, anorexia, nausea or vomiting, sometimes fever, and extreme lassitude. It is with this aspect of mountain sickness that the present work is concerned.

Medical Specialties and Equipment

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AEROMEDICAL EVACUATION LITTER PATIENT SAFETY HARNESS, by Norman E. Stingely. Rept. on Aeromedical Evacuation Equipment, Contract AF 33(600)28333. Jan 57, 85p. 3 refs. WADC Technical rept. 57-6; AD-110 695.
Order from LC mi$4.80, ph$13.80 PB 137 351

An aeromedical evacuation litter patient safety harness has been developed by New York University. WADC TR 55-333 "Aeromedical Evacuation Litter Patient Safety Device Study" which resulted from the above contract has been included as an Appendix to give medical and operational requirements for a satisfactory litter harness, and also to give design data for a harness to fit the standard rigid aluminum pole folding litter. The standard pole litter was determined as not capable of withstanding the required g loads and was therefore modified. The harness developed by New York University was modified to function with the modified litter. The psychotic restraints were deleted from the harness and it is suggested a modification of the standard wrist and ankle restraint be used in conjunction with the harness for psychotic-neurotic patients. The modified harness was dynamically tested to determine the capability of restraining a patient to the litter during controlled crash landing. Dynamic litter tests indicated that the harness would restrain the patient up to at least 7.2 g and that the patient will better withstand the impact force if he is loaded head forward in relation to the aircraft.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio
DEVELOPMENT OF PARAMEDIC AIRCRAFT-FIELD RESUSCITATOR, by Henry Seeler. Rept. on Special Breathing Devices. Aug 56, 14p. 5 refs. WADC Technical rept. 56-424; AD-112 990.
Order from LC mi$2.40, ph$3.30 PB 137 980

The Aero Medical Laboratory, which previously developed the high altitude controlled and adjustable resuscitator, extended its development program to a small and lightweight independent pararescue resuscitator kit. This can be dropped with the paramedic and is operated by means of a handcrank. A manually driven blower draws atmospheric air through a gas filter and produces air under pressure for operating

the resuscitator valve. The air blower can also be driven by a self-contained motor on either twelve or twenty-four volts, at the option of the operator. At high altitude or in hospitals, 100% or diluted oxygen can be applied.

Army Prosthetics Research Lab., Washington, D. C.
EVALUATION OF LAMINATES: H. AXIAL COMPRESSION OF CYLINDERS, by Donald H. Gittelman and Myron G. DeFries. June 55, rev. Oct 56. 54p. 22 refs. Technical rept. no. 5520.
Order from LC mi$3.60, ph$9.30 PB 138 501

Cylinders with nylon-tape end reinforcements were made from various types of stockinet, two of orlon and two of dacron, of 2-, 4-, and 6-ply respectively, in both 60:40 Paraplex P43-P13 and also 4:1 Bakelite BR18795 - 18793; plus assorted cylinders with nylon, cotton, and glass fillers. These cylinders were tested in compression applied parallel to the major axis of the cylinder.

Army Prosthetics Research Lab., Washington, D.C.
SIZING OF COSMETIC HANDS TO FIT THE CHILD AND ADULT AMPUTEE POPULATION, by Myron G. DeFries. 28 Sep 54, 12p. 2 refs. Technical rept. no. 5441.
Order from LC mi$2.40, ph$3.30 PB 139 032

The specific objectives are: (1) To present hand size data collected on groups of female adults and children at age levels of 4-6 and 10-12 years. (2) To summarize the hand size data collected by various groups and define five hand sizes suitable for the amputee population.

Pathology

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
CHANGES IN CEREBRAL OXYGEN AVAILABILITY FROM INDUCED HYPOXIA IN CATS, by N. Burr Furlong, Jr. and Marvin J. Schwarz. Rept. for June 56-June 57 on Health Hazards of Air Force Materials. Oct 58, 16p. 5 refs. WADC Technical rept. 58-322; AD-203 904.
Order from OTS $0.50 PB 151 542

The polarographic measurement of cerebral tissue oxygen availability in cats under a variety of environmental conditions has been made possible through permanent implantation of platinum electrodes in brain tissues. A linear relationship between decreased oxygen partial pressures and recorded cerebral oxygen availability was demonstrated in both nitrogen dilution and altitude pressure chamber experiments. Increased oxygen partial pressures raised the cerebral oxygen availability by a maximum of 50%. Changes in mean arterial blood pressure produced by centrifugal force resulted, after a short time lag, in closely correlated changes in the oxygen availability. Expected changes in oxygen availability were observed with carbon monoxide, sodium nitrite, and sodium cyanide-induced hypoxia. High concentrations of carbon dioxide in the inspired air produced indications of possible increases in oxygen availability.

Naval Medical Research Inst., Bethesda, Md.
RAPID MICRO-TECHNIQUE FOR THE DETERMINATION OF SALIVARY HYALURONIDASE BY STREPTOCOCCAL DECAPSULATION TEST, by M. G. Wheatcroft and J. L. Nemes. Vol. 14, p. 625-632.
18 Sep 56, 7p. 8 refs. Proj. NM 008 012.04.03
Order from LC mi$1.80, ph$1.80 PB 137 717

School of Aviation Medicine, Randolph AFB, Tex.
AIR EVACUATION OF MAXILLOFACIAL PATIENTS, by Lucian Szmyd and Clarence M. McCall, Jr. Oct 57, 10p. 27 refs. Aeromedical Reviews no. 2-58.
Order from LC mi$1.80, ph$1.80 PB 137 573

The hazards of indiscriminate removal of intermaxillary fixation in order to transport maxillofacial patients are pointed out. Two simple, but effective, quick-release mechanisms of jaw fixation are described and illustrated.

School of Aviation Medicine, Randolph AFB, Tex.
SINUS BAROTRAUMA: TREATMENT, by Ralph N. Kraus. Oct 58, 12p. 8 refs. Aeromedical reviews no. 1-59.
Order from LC mi$2.40, ph$3.30 PB 137 965

The physiology and pathology of sinus barotrauma have been reviewed. A successful regimen for treatment has been presented. The simple office procedure of infraction of the middle turbinate will frequently relieve the acute symptoms and should be tried in recurrent cases in which the cause is not obvious. A submucous resection is indicated when the septum impinges on the middle turbinate and prevents infraction of the turbinate. Examples of sinus barotrauma by a retention cyst in the maxillary sinus and an osteoma of a frontal sinus have been presented.

School of Aviation Medicine, Randolph AFB, Tex.
SYNCOPE IN A POPULATION OF HEALTHY YOUNG ADULTS: INCIDENCE, MECHANISMS, AND SIGNIFICANCE, by George Dermksian and Lawrence E. Lamb. July 58, 18p. 15 refs. Rept. 58-132.
Order from LC mi$2.40, ph$3.30 PB 136 705

Eighty-two cases of syncope occurring in flying personnel were studied extensively to ascertain the mechanisms involved. The cardiac arrhythmias are a major factor in causing inefficient pumping action of the heart. Cardiac arrhythmias may be induced by the pulmonary stretch reflex. The stretch reflex may be stimulated by common breathing maneuvers such as breath-holding or by pressure breathing. It may be of significance in operating rooms—producing cardiac arrhythmias and cardiac arrest during artificial respiration. The vagal response to the stretch reflex is abolished by atropine. Recognition of the role of the stretch reflex in syncope and cardiac arrest, as well as a means of its prevention, has immediate application in industry and medicine.

Pharmacology and Toxicology

Medical Equipment Development Lab., Fort Totten, N. Y.
PREVENTION OF DETERIORATION: SULFADIAZINE SODIUM INJECTION USP, 5 Gm., 20cc., FSN 6505-146-2300, by Donald O. Jones. 28 June 57, 5p. 6 refs. Memo. rept. no. 57-2.
Order from LC mi$1.80, ph$1.80 PB 136 116

A study is to develop methods of improving product stability in Sulfadiazine Sodium Injection. The research investigation includes the general problem of combating deterioration, with specific attention being given to preventing the appearance of the following defects upon aging: (1) Development of a precipitate. (2) Discoloration of the solution.

Office of Scientific Research and Development. Div. 9.
PREPARATION, STABILITY AND IRRITANCY OF PROTECTIVE OINTMENTS, by Homer Adkins, E. Earl Royals, and A. L. Wilds (U. of Wisconsin). Progress rept. for Mar-Sep 43 on Contract OEMsr-304. 2 Dec 44, downgraded 11 Aug 49, declassified [5 Nov 53]. 48p. OSRD-4419; ATI-30253.
Order from LC mi$3.30, ph$7.80 PB 136 674

Thirteen chloroamides were investigated to determine their suitability for incorporation into protective ointments. The irritancy of the ointments was found to be greatly dependent on the chloroamide used. S-330, S-145, and impregnite E gave the least irritant ointments and of these, the ointments prepared from S-330 were also outstanding with respect to storage and thermal stability, and cosmetic and physical properties.

School of Aviation Medicine, Randolph AFB, Tex.
ASPIRIN AND PLACEBO IN ORAL SURGERY, by Lucian Szmyd, Clarence M. McCall, and Albert L. Porreca. May 58, 4p. 12 refs. Rept. 58-81.
Order from LC mi$1.80, ph$1.80 PB 137 203

The use of aspirin to control postoperative pain in oral surgery was evaluated clinically. Three groups of subjects were given placebo, placebolike capsules containing aspirin, and aspirin tablets, respectively. In the placebo group, there were fewer cases of severe and moderate pain than in the tablet group, but more cases of slight pain. Results for the capsule group fell between those of the other groups.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECTIVENESS OF VARIOUS DRUGS FOR THE PROPHYLAXIS OF SICKNESS, by Herman I. Chinn, Stanley W. Handford (Naval Medical Field Research Lab.) and others. Mar 52, 9p. 17 refs. Proj. no. 21-32-014, rept. no. 6.
Order from LC mi$1.80, ph$1.80 PB 135 458

Lergigan, Trimeton, Benadryl-scopolamine mixture, and Wellcome Preparation No. 47-83 all provided approximately equal protection against seasickness. No protection was given by the antihistaminic Diatrin or by the antispasmodics W-290 and Prantal. Side effects were minimal in all cases except among those persons receiving the Scopodex. There was an inverse relation between the incidence of vomiting and the age of the subject.

School of Aviation Medicine, Randolph [AFB] Tex.
EFFECTS OF CERTAIN MOTION-SICKNESS PREVENTIVES UPON NAVIGATOR PROFICIENCY, by Robert B. Payne, Dale R. Osier, and P. A. S. Tomlinson. May 53, 11p. 8 refs. Proj. no. 21-1601-0004, rept. no. 1.
Order from LC mi$2.40, ph$3.30 PB 135 466

The two experiments reported here were designed to answer two questions: (a) what are the magnitudes of effect? and (b) are the effects in any sense predictable from studies based upon aptitude test methods applied to populations of volunteer basic airmen? The first experiment explored drug effects upon proficiency exhibited in a four-hour, airborne map-reading mission. The results were inconclusive, but the null hypothesis is not necessarily regarded as the best alternative. The second experiment dealt with effects upon proficiency exhibited in a three-hour celestial trainer mission. Statistically reliable adverse effects were observed. Relative rather than absolute magnitudes of effect were highly predictable from results obtained earlier with navigator aptitude test methods. Testable hypotheses concerning factors which may modify adverse drug effects are proposed.

Radiobiology

Duke U., Durham, N. C.
ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO PEPTIDES, by Gene McCormick and Walter Gordy. [Rept. for 1 Nov 57-1 Feb 58] 42p. 7 refs. AFOSR TN-58-133; AD-152 160.
Order from LC mi$3.30, ph$7.80 PB 136 127

Naval Medical Research Inst., Bethesda, Md.
RELATIVE BIOLOGICAL EFFECTIVENESS OF ATOMIC BOMB GAMMA RADIATION IN MICE, by E. P. Cronkite, V. P. Bond (Naval Radiological Defense Lab.) and others. 28 May 55, v. 13, p. 89-112. 17 refs. Research rept. proj. NM 006 012.04.86.
Order from LC mi$2.70, ph$4.80 PB 136 277

The object of this study was to measure the lethal effects of atomic bomb nuclear radiations as a function of distance from the weapon and as a function of measured dose. Mice were used as the test object and were exposed in 28 cylindrical containers placed at graded distances from a bomb of known kilotonnage. Exposure apparatus capable of protecting the animals from blast, thermal radiation, and radioactive dust was employed. The implications of the present study are discussed with respect to characterizing fully the mortality response of LAf_1 mice to penetrating radiations. Survivors of the study were sent to the Oak Ridge National Laboratories for study of tumor and cataract incidence.

Radiobiological Lab., U. of Texas. Austin.
SOME EFFECTS OF NUCLEAR RADIATION EXPOSURE ON THE BEHAVIOR OF THE RHESUS MONKEY, by A. A. McDowell and W. Lynn Brown. Apr 58, 4p. 5 refs. AFSAM 58-58.
Order from LC mi$1.80, ph$1.80 PB 135 920

The behavior of rhesus monkeys was studied after they had been exposed to nuclear radiation. Deficits were shown in nondirected locomotor activity and in object-directed activity; an increment was shown in self-directed activity. This behavioral syndrome is comparable to that produced in monkeys by laboratory exposure to radiation.

Smith, E. H., and Co., Silver Spring, Md.
ANALYSIS OF ANIMAL WHOLE-BODY IRRADIATION DATA, by E. H. Smith. Preface to Published edition. 9 Dec 57, 205p. AFSWP-496.
Order from LC mi$9.30, ph$31.80 PB 137 298

The purpose of the present data study is to supplement the study of 1953 by adding recent experiments. Also, the accuracy of instrumentation, the effects of backscatter, depth dosage, radiation energy, and so forth, on measurement reliability and biological response are considered as to their effect on measured acute LD-50 values for various species. A great amount of experimental data on both chronic and acute irradiation of animals has been considered. Certain future experiments are suggested, and certain factors affecting the design and conduct of irradiation experiments are discussed.

CHEMISTRY

Atomic Energy Research Establishment (Gt. Brit.)
THE POLONIUM CHEMISTRY PROJECT (AUGUST 1953 - APRIL 1958) by K. W. Bagnall, J. H. Freeman and others. July 58, 18p. 32 refs.
Order from BIS $0.59 AERE C/R 2566

Contents
The preparation of pure polonium metal
Preparative
Polonium compounds
- Polonium dioxide
- The polonium halides
- The polonium halates
- Salts of oxyacids
- Polonium hydride
- Polonium acetylacetonate
- Sexavalent polonium
- Other chemical data

Analytical Chemistry

Atomic Energy Research Establishment (Gt. Brit.)
COLORIMETRIC DETERMINATION OF PLUTONIUM IN MICROGRAM QUANTITIES, by T. V. Healy and P. E. Brown. Nov 53, declassified June 57, 25p. 3 refs.
Order from BIS $0.77 AERE C/R 1287

A method has been developed for the determination of plutonium over the range 5 to 100 μg with an accuracy of ± 1% at the 100 μg level. The coloured complex between tetravalent plutonium and the commercial reagent Thoronol [1 - o - arsenophenyl azo) - 2 napthol - 3 - 6 - disulphonic acid] is measured on a Spekker Absorptiometer. This can be used to estimate the amounts of the three, four and six valent states present in a plutonium sample. The thoronol complexes formed with ferric and uranyl ions have been examined at different acidities. Methods are suggested to remove or to minimise the effects due to most of the complexing cations such as iron or anions such as fluoride.

Atomic Energy Research Establishment (Gt. Brit.)
IMPROVED ANALYTICAL METHODS OF SEPARATING LEAD, by G. W. C. Milner, J. W. Edwards, and A. Paddon. July 58, 7p. 6 refs.
Order from BIS $0.37 AERE C/R 2612

Ion exchange and solvent extraction methods have been investigated for the separation of lead in the analysis of lead base materials. Lead can be held on a column of Deacidite FF from 2M HBr solutions and this has been used in the analysis of lead for alloying amounts (0.025-9%) of thorium. The thorium in the eluate is determined by titration with EDTA to the xylenol orange end point in the pH range 2.5 - 3. Very small amounts are determined absorptiometrically by the thoronol method. In a solvent extraction method for this separation, a 0.1 - 1 N acid solution of the sample is shaken with a solution of diethylammonium diethyldithiocarbamate in trichloroethylene before titration of the aqueous solution with EDTA or completion of the thorium determination with thoronol.

Atomic Energy Research Establishment (Gt. Brit.)
SPECTROGRAPHIC DETERMINATION OF MAGNESIUM IN BISUMTH-URANIUM ALLOYS, by J. C. Cotterill. June 58, 9p. 3 refs.
Order from BIS $0.37 AERE C/R 2456

Bismuth alloys are converted to oxide and mixed with a spectrographic buffer containing ferric sulphate. Pellets of this mixture are excited in the D.C. arc using copper electrodes and spectra are evaluated by microphotometry using the iron as internal standard. The effective concentration range is 50 - 700 p.p.m. The coefficient of variation for single spectra is 5% at the 300 p.p.m. level.

Power Plant Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A COLORIMETRIC DETERMINATION OF HYDROFLUORIC ACID IN FUMING NITRIC ACID, by Hugh E. Malone. May 57, 14p. WADC Technical note 57-271; AD-130 952.
Order from LC mi$2.40, ph$3.30 PB 137 976

Inorganic Chemistry

[Armed Services Technical Information Agency, Arlington, Va.]
SILICON, QUARTZ AND SILICANES. A REPORT BIBLIOGRAPHY. Nov 54, 40p. 312 refs. ARC 1327; AD-50 112.
Order from LC mi$3.00, ph$6.30 PB 139 044

A selected list of references on cordierite, elastomers, feldspars, fluosilicate, mica, quartz, quartz crystals, silicanes, silicate crystals, silicates, silicides, silicon, silicon alloys, silicon carbide, silicon coatings, silicon compounds, silicon crystals, silicon dioxide, silicon fluoroacetates, silicon halides, silicon isotopes, silicone, silicone resins, silicones, silicones (polymerized), talc.

Florida State U., Tallahassee.
STRUCTURE AND BOND TYPE IN MOLECULAR COMPLEXES, by Raymond K. Sheline, Richard W. Wolfgang, and Roland E. Johnson. Final technical rept. for 1 Feb 55-30 June 57 on Contract DA 01-009-ORD-461. [1957] 12p. 23 refs.
Order from LC mi$2.40, ph$3.30 PB 139 004

This project was undertaken to analyse the structure and bond types in molecular complexes by spectroscopic methods and by isotopic exchange reactions.

Hydrogen Peroxide Labs., Mass. Inst. of Tech., Cambridge.
QUARTERLY PERIODIC STATUS REPORT, by W. C. Schumb and C. N. Satterfield. Rept. on Contract Nonr-1841(11). 30 June 57, 9p.
Order from LC mi$1.80, ph$1.80 PB 135 443

Contents:
Stability of hydrogen peroxide
Effect of aluminum upon hydrogen peroxide solutions containing stannate
Decomposition rates of dilute hydrogen peroxide
Flame velocities in hydrogen peroxide vapor
Supercooling of liquid hydrogen peroxide
High pressure ignition limits of hydrogen peroxide vapor

Inorganic Research Lab., Western Reserve U., Cleveland, Ohio.
INORGANIC MACROMOLECULES: BORON, NITROGEN SYSTEMS, by Charles A. Brown. Final rept. on Contract Nonr-1439(02). 30 Sep 56, 15p.
Order from LC mi$2.40, ph$3.30 PB 135 739

The work was divided into two phases: efforts were made to prepare polymeric materials of moderate to high molecular weights and of high thermal stability. Methods of syntheses were designed to establish in the polymers frameworks of Ti-O-Si or B-N. Although our work did not produce high polymers, some examples of simple substances of unusual thermal stability were found. Tetrakistriphenyloxytitanium, and tetrakistriphenylsiloxysilane, are of special interest.

Massachusetts Inst. of Tech., Cambridge.
MECHANISM OF CATALYTIC DECOMPOSITION OF HYDROGEN PEROXIDE BY OXIDES OF LEAD, by D. B. Broughton, R. L. Wentworth and others. Rept. no. 12 on Contract NOrd-9107. 1 Dec 46, 56p.
D. I. C. 6351; AD-138 643.
Order from LC mi$3.60, ph$9.30 PB 137 387

National Advisory Committee for Aeronautics, Washington, D. C.
RATE OF REACTION OF GASEOUS FLUORINE WITH WATER VAPOR AT 35° C, by Vernon A. Slabey and Edward A. Fletcher. Sep 58, 16p. 6 refs. AD-202 098L.
Order from NASA NACA TN-4374

Fluorine and water vapor react extremely slowly or not at all in the gas phase at 35° C at partial pressures of the reactants up to 40 mm of mercury. They react at surfaces; the kinetics are first order with respect to each of the reactnats. At Kel-F wax-coated surfaces, the rate of disappearance of fluorine is expressed by $-\frac{dF_2}{dt} = 1.6 \times 10^{-4} A_w[F_2][H_2O]$, where $-\frac{dF_2}{dt}$ is the rate of disappearance of fluorine in moles per second, A_w is the surface area (sq cm) of the reaction vessel, and $[F_2]$ and $[H_2O]$ are the concentrations in moles per liter of the reactants. Neither ozone nor hydrogen peroxide is formed to a measurable extent in the reaction.

Pennsylvania State U. Coll. of Mineral Industries, University Park.
ATOMISTIC INTERPRETATION OF THE AGING OF ALUMINUM HYDROXIDE GEL, by S. Bentur and Evelyn C. Marboe. Technical rept. no. 74 on Contract N6onr-269(08). Aug 57, 27p. 22 refs.
Order from LC mi$2.70, ph$4.80 PB 135 726

Organic Chemistry

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
SELF-EMULSIFYING CLEANERS: 1, 4-DIAZA-4-CYCLOHEPTENES, by J. Sprague. Jan 58, 22p. 10 refs. CCL # 46.
Order from LC mi$2.70, ph$4.80 PB 135 342

Reaction products of ethylene diamine and diacetone alcohol have previously been shown to have value in cleaners. One product has been identified as 5, 7, 7-trimethyl-1, 4-diaza-4-cycloheptene. The object of this investigation is to determine the scope of the reaction between 1, 2-diamines and β-hydroxyketones or α, β-unsaturated ketones. It would appear that the use of β-hydroxyketones wherein the hydroxyl group is other than tertiary will not succeed. Similarly, x, β unsaturated ketones may not succeed if the β-carbon

atom is not fully substituted. The structure of the condensate between o-phenylenediamine and mesityl oxide is demonstrated indicatively to be 5, 7, 7-trimethylbenzo(b)-1, 4-diaza-4-cycloheptene. These reactions should be more fully studied.

Microwave Lab., Duke U., Durham, N. C.
ELECTRON SPIN RESONANCE STUDIES OF RADIATION DAMAGE TO AMINO ACIDS, by Howard Shields and Walter Gordy. Rept. no. 20, pt. 1, 1 Nov 57 to 1 Feb 58 on Contract AF 18(600)497. 64p. 5 refs. AFOSR TN-58-134; AD-152 161.
Order from LC mi$3.90, ph$10.80 PB 136 383

Naval Research Lab., Washington, D. C.
TAUTOMERISM IN PHOSPHORUS CHEMISTRY. PART I. DEUTERIUM EXCHANGE STUDIES WITH DIBUTYL PHOSPHONATE, by R. B. Fox. 8 Jan 59, 19p. 38 refs. NRL Rept. 5242.
Order from OTS $0.50 PB 151 227

A study has been made of prototropy in dialkyl phosphonates in nonaqueous solvents. The movements of the hydrogen atom in the >P(O)H - >POH system found in these compounds have been followed by the uptake of deuterium on the basis of rapid exchange with O-H hydrogen and very slow exchange with P-H hydrogen. Exchange between di-n-butyl phosphonate and n-butyl alcohol-d both in alcohol and in alcohol and n-octane has been followed in the presence and absence of acidic and basic catalysts. It has been found that although a prototropic equilibrium in this system exists in acidic solutions, the extent of such equilibria in neutral solution is not much more than that found in acetone. In basic solutions, there is probably no rate-controlling prototropic equilibrium in reactions with deuterium ion.

Ohio State U. Research Foundation, Columbus.
DESIGN AND USE OF A GAS CHROMATOGRAPHIC APPARATUS FOR THE ISOLATION OF ORGANIC REACTION PRODUCTS, by A. Arkell and M. S. Newman. Rept. on Contract AF 33(616)3412. July 58, 23p. WADC Technical note 58-220; AD-202 332.
Order from OTS $0.75 PB 151 543

The design and construction of a versatile vapor-phase chromatograph for use in organic chemical research is described. The apparatus consists of seven major components: heated injection system, column, heated exit system, trapping system, detector, bridge circuit, and recorder. Helium is employed as the carrier gas. Optimum conditions for operation are indicated, and recommendations for improvement of future units are given. Two kinds of applications for the equipment are illustrated on a case-history basis: the analytical investigation of the optimum reagents for carrying out a synthesis (dehydration of di-t-butyl-methyl carbinol to 1, 1-di-t-butylethylene), and the large-scale workup of a complex reaction mixture (obtained from thermal decomposition of 2, 2, 5, 5-tetramethyl-4-diazo-3-hexanone) to obtain a pure product (2, 3, 5, 5-tetramethyl-2-hexene-4-one).

Oklahoma U., Norman.
ULTRAVIOLET AND INFRARED ABSORPTION SPECTRA OF ORGANOBORON COMPOUNDS, by P. L. Pickard, C. L. Dulaney, and G. W. Polly. [Rept. on subcontract to Contract NOa(s) 52-1024]. Feb 55, 13p. 4 refs. Rept. no. CCC-1024-TR-96; AD-121 084.
Order from OTS $0.50 PB 151 154

The infrared spectra of seven trialkylboranes were measured, and the characteristic absorption bands in the region 799 to 1470 cm^{-1} were recorded. An attempt was made to develop an analytical method using the absorption in the ultraviolet region. Amine-boron trifluoride complexes, boranes, pyridine-borane complexes, hydroxy-boranes, and amine-boric acid complexes were run, as well as solutions of boric acid and diols mixed with amines or hydroquinone. All of the experiments were unsuccessful from the standpoint of a practical analytical method.

Polytechnic Inst. of Brooklyn, N. Y.
DECOMPOSITION OF PEROXYCARBAMATES AND THEIR EFFICIENCY AS INITIATORS OF VINYL POLYMERIZATION, by Eugene L. O'Brien (Doctor's thesis) F. Marshall Beringer, and Robert B. Mesrobian. Technical rept. no. 10 on Contract N6onr-263(09). June 57, 26p. 10 refs.
Order from LC mi$2.70, ph$4.80 PB 135 205

This study describes the preparation of three peroxycarbamates and their decomposition in various solvents including styrene monomer. By determination of the efficiency of initiation of styrene polymerization it is possible to investigate the reactivity of radical intermediates obtained during decomposition.

[Technical Research Group] New York
PROPERTIES OF POLYETHYLENE AND RELATED POLYMERS, by Chonon Heller, Saul Levinson, and Carole Nudelman. Rept. on Contract AF 33(616)3616. Apr 57, 54p. 20 refs. WADC Technical Note 57-430; AD-207 338.
Order from OTS $1.50 PB 151 584

Polyethylene has been used for a wide variety of applications. This report covers several of the more important methods of synthesis. Physical and mechanical properties of polyethylene are determined by the structure and crystallinity. The structure of polyethylene, polymethylene, and related polymers are compared and discussed. The interaction of polyethylene and radiation are treated with respect to cross linking, gas evolution, change in melting point, change in composition, and changes in crystallinity.

Physical Chemistry

Air Force Cambridge Research Center, Bedford, Mass.
GASEOUS EQUILIBRIA IN THE CARBON-SILICON BINARY SYSTEM, by J. Smiltens. July 58, 38p. 14 refs. AFCRC TR-58-161; AD-152 446.
Order from LC mi$3.00, ph$6.30 PB 137 464

A method is presented for calculating the pressure and composition of the vapor phase in the carbon-silicon binary system. The following quantities are necessary partition functions of the various molecular species present in the vapor, vapor pressures of graphite and liquid silicon, and the standard free-energy increment for the change
C(graphite) + Si(liquid) = SiC(solid). A study is made of the equilibrium: vapor and solution of carbon in liquid silicon.

Amherst Coll., Mass.
COMPONENTS OF CHARGE POTENTIAL IN THE NON-DIFFUSE REGION OF THE ELECTRICAL DOUBLE LAYER. POTASSIUM IODIDE SOLUTIONS IN CONTACT WITH MERCURY AT 25°, by David C. Grahame. Technical rept. no. 5, 2nd series, on Thermodynamic Properties of the Electrical Double Layer, Contract Nonr-2309(01). Aug 57, 39p. 15 refs.
Order from LC mi$3.00, ph$6.30 PB 135 872

Amherst Coll. Mass.
RESEARCH STUDIES LEADING TO FUNDAMENTAL DATA CONCERNING CARBON BLACKS, by Ralph A. Beebe. Quarterly progress rept. nos. 2-8, 1 June 56-28 Feb 58, on Contract DA 36-039-sc-70124. 7 nos.
Order from LC

The objective of this project is to investigate the nature of adsorbed films of gases or vapors on solid surfaces and to study the variation in properties of these films with change in physical structure and chemical composition of the adsorbents.
Quarterly progress rept. no. 2, 1 June-31 Aug 56, 7p. mi$1.80, ph$1.80, PB 136 093
Quarterly progress rept. no. 3, 1 Sep-30 Nov 56, 7p. mi$1.80, ph$1.80, PB 136 094
Quarterly progress rept. no. 4, 1 Dec 56-28 Feb 57, 7p. mi$1.80, ph$1.80, PB 136 095
Quarterly progress rept. no. 5, 1 Mar-31 May 57, 29p. mi$2.70, ph$4.80, PB 136 096
Quarterly progress rept. no. 6, 1 June-31 Aug 57, 18p. mi$2.40, ph$3.30, PB 136 097
Quarterly progress rept. no. 7, 1 Sep-30 Nov 57, 30p. mi$2.70, ph$4.80, PB 136 098
Quarterly progress rept. no. 8 (Final), 1 Dec 57-28 Feb 58, 19p. mi$2.40, ph$3.30, PB 136 099

Antioch Coll., Yellow Springs, Ohio
HYDROTHERMAL REACTIONS UNDER SUPERCRITICAL CONDITIONS. III. THE EFFECT OF pH ON THE CRYSTALLIZATION OF SILICON DIOXIDE, by Richard G. Yalman and James F. Corwin. Suppl. to Final rept. for 1 Feb 55-31 Jan 57 on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-64605. Jan 57, 25p. 20 refs. AD-130 704.
Order from LC mi$2.70, ph$4.80 PB 137 199

The reactions of silica glass have been studied under isothermal conditions at 400°C and 5000 p. s. i.

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Quarterly rept. nos. 1-7, 1 Feb 55-31 Oct 56, on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-64605. 7 nos.
Order from LC

Quarterly rept. no. 1, 1 Feb-30 Apr 55, 21p. mi$2.70, ph$4.80, PB 137 282
Quarterly rept. no. 2, 1 May-31 July 55, 22p. mi$2.70, ph$4.80, PB 137 283
Quarterly rept. no. 3, 1 Aug-31 Oct 55, 27p. mi$2.70, ph$4.80, PB 137 284
Quarterly rept. no. 4, 1 Feb 55-31 Jan 56, 36p. mi$3.00, ph$6.30, PB 137 285
Quarterly rept. no. 5, 1 Feb-30 Apr 56, 42p. mi$3.30, ph$7.80, PB 137 286
Quarterly rept. no. 6, 1 May-31 July 56, 37p. mi$3.00, ph$6.30, PB 137 287
Quarterly rept. no. 7, 1 Aug-31 Oct 56, 19p. mi$2.40, ph$3.30, PB 137 288

Antioch Coll., Yellow Springs, Ohio.
PHYSICAL CHEMISTRY OF AQUEOUS SOLUTIONS, by James F. Corwin. Final rept. for 1 Feb 55-31 Jan 57 on Research on Aqueous Solutions at or above the Critical Temperature of Water, Contract DA 36-039-sc-64605. Jan 57, 54p. 29 refs. AD-95 175.
Order from LC mi$3.60, ph$9.30

The over-all aim of this contract has not changed over the period of two years, but specific aims of the several sections have been modified and one section added. The work on conductivity of water and water solutions at high temperatures and pressures was split directly between the two projects. The work on GeO_2 was transferred. The remainder of the work was shared in various degrees and an additional section was added which was concerned with giving geological implications of all work. The general purpose of each phase are as follows: 1. The measurement of conductivity and other related phenomena in water and water solutions. 2. The reactions of alkaline earth metal oxides (i. e. calcium, barium, strontium, magnesium, and beryllium) with fused silica. 3. The work on mechanisms of crystallization of silica was concerned with the relationship of pH to the type of crystalline silica formed by using several types of buffer solutions and the mechanism of fluoride ion reaction with silica. 4. The substitution of GeO_2 for SiO_2 in a full series of reactions. 5. Crystal structure determination by optical methods and giving geological significance to results. (See also PB 137 282 - PB 137 288)

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
GAS FLOW TRACING IN BAFFLE-STABILIZED FLAMES, by H. L. Olsen, E. L. Gayhart, and L. W. Bennett. Rept. on Contract NOrd-7386. Dec 54, 16p. 1 ref. CM-826.
Order from LC mi$2.40, ph$3.30 PB 137 525

Three experimental techniques have been developed for use in studying the gas flow existing within baffle-stabilized flames. These techniques allow a fairly detailed description to be given of the gas flow in and

about the flames. One method allows quantitative determination of the magnitude of the gas velocity within the recirculation zone. The other methods are useful in showing the general nature of the flow pattern and in giving some indication of the direction of flow within the recirculation zone.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE EFFECTS ON FLAME PARAMETERS WHEN HYDROGEN OR DEUTERIUM IS ADDED TO A STOICHIOMETRIC CARBON MONOXIDE-OXYGEN MIXTURE, by Robert A. Wires. June 58, 46p. 32 refs. Rept. no. 1050.
Order from LC mi$3.30, ph$7.80 PB 137 554

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF LIMITS OF FLAME STABILITY OF DISK FLAME HOLDERS IN A FREE STREAM, by Gustave G. Kutzko. Rept. on Ramjet Technology, Contract AF 33(038)12656. Apr 56, 17p. 1 ref. WADC Technical rept. 55-134.
Order from LC mi$2.40, ph$3.30 PB 136 173

An important part of certain combustion systems is a flame holder or bluff body which furnishes a stabilized flame in a confined high-velocity stream of gases where combustion takes place. An understanding of the behavior of such a flame holder has been hampered in the past by the interaction of other components of the combustion system with the flame-holding process. Therefore, studies are being made at Battelle Memorial Institute in an open system, consisting of a disk flame holder placed in the gas stream issuing from an accelerating nozzle. This experimental procedure eliminates most of the undesired interactions, but introduces the complication of air's being entrained into the flame. Results obtained show that proper experimental techniques can ensure that the flame is burning completely within the combustible-gas stream. The limitations imposed on the experimental test by air entrainment are shown, and the effect of the flame-holder mounting wires on blowoff data is evaluated. The stability limits of open and closed systems are compared. It is found that the innate stability of the disk-held flame is much higher than previous work in closed systems discloses.

California U., Berkeley.
SIMPLE MOLECULAR ORBITAL TREATMENT OF HYPERCONJUGATION, by A. Streitwieser, Jr. and P. M. Nair. Rept. on Contract AF 49(638)1212. 1 July 58, 37p. 32 refs. AFOSR TN-58-590; AD-162 114.
Order from LC mi$3.00, ph$6.30 PB 136 161

A modification of the simple molecular orbital theory has been successfully applied to the treatment of ionization potentials of unsaturated molecules. Of the several models examined for the hyperconjugative effect of a methyl group, best results were obtained for a model in which the methyl group is treated as a single "heteroatom" which donates two electrons to the π-system.

Esso Labs., Linden, N. J.
FUNDAMENTAL STUDIES OF COMBUSTION, ER 053-001, by A. J. Blackwood. Progress rept. no. 35, 6 Aug-6 Oct 48 on Contract N6ori-109. 22 Nov 48, 13p. ATI-63 657.
Order from LC mi$2.40, ph$3.30 PB 136 230

Esso Labs. [Linden, N. J.]
FUNDAMENTAL STUDIES OF COMBUSTION, by W. P. Lakin, H. L. Thwaites and others. Annual rept. no. 4 (Final) 7 Nov 47-30 Nov 48, on Contract N6ori-109; Continuation of Contract NObs-22036. 30 Nov 48, 95p. Rept. no. RL-5M-48(69); ATI-64 126.
Order from LC mi$5.40, ph$15.30 PB 139 027

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
MECHANISM AND KINETICS OF THE REACTION BETWEEN FUMING NITRIC ACID AND/OR ITS DECOMPOSITION PRODUCTS AND GASEOUS HYDROCARBONS, by Francis R. Taylor, Rachel G. Franklin, and Orest N. Rudyj. Rept. on Chemical Reactions of Liquid Rocket Oxidizers, Contract AF 33(616)3840. Mar 58, 42p. 16 refs. WADC Technical rept. 58-228; AD-155 550.
Order from OTS $1.25 PB 151 521

A study was made of the ignition properties of propane-nitrogen dioxide mixtures. Thermally induced explosions of these mixtures were investigated as a function of pressure, temperature, composition, and vessel size over a temperature range of 300 to 850° C and a pressure range of 20 to 500 mm. Hg. Oscilloscope traces of the light emitted by the explosions indicate that two different modes of reaction are possible in this system: a short-duration cool flame and a longer-duration hot flame. A modified form of Semenoff's equation is used to relate minimum cool and hot flame ignition pressures to mixture composition and vessel size. Infrared analyses were made of the products of the cool and hot flame reactions. The major products of the cool flame were nitric oxide, methane, ethylene, and carbon monoxide. The hot flame reaction consumes methane, ethylene, and nitric oxide, producing carbon monoxide. Variation of the concentration of intermediate compounds occurring in nonluminous and cool-flame reactions suggests that the initial reaction between propane and nitrogen dioxide proceeds through formation of a complex of uncertain identity. It is believed that this complex subsequently produces nitroethane. The latter decomposes rapidly to produce principally methane, ethylene, nitric oxide, and carbon monoxide. Also, it has been deduced from the changes in product distribution that the second-stage flame is initiated by the reaction between ethylene produced by the cool flame and nitrogen dioxide. When this flame becomes sufficiently hot, other reactions begin to take place, including oxidation of methane by nitric oxide.

Gates and Crellin Labs. of Chemistry, Calif. Inst. of Tech., Pasadena.
ELECTRON DIFFRACTION INVESTIGATIONS OF THE MOLECULAR STRUCTURES OF CERTAIN COMPOUNDS OF BORON AND OF VOLATILE COMPOUNDS OF THE HEAVY ELEMENTS, by Verner Schomaker.

Technical rept. no. 6 on Contract N6onr-244(23). Sep 56, 12p. 8 refs.
Order from LC mi$2.40, ph$3.30 PB 136 020

James Forrestal Research Center, Princeton, N. J.
REDETERMINATION OF THE LEAD-LEAD SULFIDE EQUILIBRIUM BETWEEN 620° AND 920° C, by J. R. Stubbles and C. E. Birchenall. Rept. on Contract AF 18(600)967. 16 May 58, 10p. 7 refs. Metallurgy rept. no. 16; AFOSR TN-58-470; AD-158 281.
Order from LC mi$1.80, ph$1.80 PB 136 269

The equilibrium between lead, lead sulfide, and circulating atmospheres of hydrogen and hydrogen sulfide has been measured between 620° and 920° C. The equilibrium atmospheres were analyzed by an iodimetric method. The data may be represented by a linear free energy equation, whose enthalpy and entropy terms have associated errors of ∓ Kcal. and ∓ 1 e. u. Reasons are given for accepting the new data in preference to that which already exists.

Illinois U. Engineering Experiment Station, Urbana.
PREPARATION OF PHOSPHIDES BY FUSED SALT ELECTROLYSIS AND RELATED SUBJECTS, by C. E. Myers, P. N. Yocom, and C. C. T. Cheng. Interim progress rept. for 1 Dec 55-31 Aug 56 on Contract N6ori-071(11). Sep 56, 19p. 18 refs. AD-130 482.
Order from LC mi$2.40, ph$3.30 PB 135 621

The difficulties encountered in the preparation of certain phosphides by fused salt electrolysis of phosphate-metal oxide-fluoride melts have been shown to be due to incomplete dehydration of the melts, loss of fluoride as HF, and formation of excess pyrophosphate in the melts. Evidence for the existance of NiP and the nonexistance of V_2P is presented. Some factors affecting the course of the electrolysis are discussed. Direct combination has been found to be more satisfactory than fused salt electrolysis for the preparation of the silicides of iron, cobalt, and nickel for projected studies.

Imperial Coll. of Science and Tech., London (Gt. Brit.).
ANALOGUE SOLUTION OF TEMPERATURE DISTRIBUTION AND EXTINCTION IN AN IDEALISED CYLINDRICAL FLAME, by D. B. Spalding and M. D. Samain. Rept. on Contract AF 61(514)1014. Jan 58, 20p. 4 refs. AFOSR TN-58-216; AD-154 117.
Order from LC mi$2.40, ph$3.30 PB 136 263

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
THERMOLUMINESCENCE ANF F CENTERS. PART I, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Rept. on Contract AF 61(514)1333. [1958] 13p. AFOSR TN-58-355; AD-154 260.
Order from LC mi$2.40, ph$3.30 PB 135 367

The interpretation of the thermoluminescence experiments according to the current theories is critically reviewed. Its inconsistency is shown, at least with reference to the thermoluminescence associated with F-Centers in alkali halides. A model to interpret this phenomenon is advanced, to be quantitatively discussed in a next paper.

Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy).
THERMOLUMINESCENCE AND F CENTERS. PART II, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Rept. on Contract AF 61(514)1333. [1958] 16p. AFOSR TN-58-356; AD-154 261.
Order from LC mi$2.40, ph$3.30 PB 135 371

Istituto Elettrotecnico Nazionale "Galileo Ferraris" [Italy].
THERMOLUMINESCENCE AND F CENTERS. PART III, by Guido Bonfiglioli, Piero Brovetto, and Cesare Cortese. Rept. on Contract AF 61(514)1333. [1958] 14p. AFOSR TN-58-357; AD-154 262.
Order from LC mi$2.40, ph$3.30 PB 135 372

The theory of the mechanism outlined in part I, to interpret F-Centers thermoluminescence in X-Rays irradiated NaCl, is exposed in first approximation. Possible refinements will appear in a next paper.

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
TRANSITION OF THE FERROELECTRIC STATE IN BARIUM TITANATE, by D. Meyerhofer. Rept. on Contract Nonr-1841(10). Oct 57, 68p. 31 refs. Technical rept. 121.
Order from LC mi$3.90, ph$10.80 PB 136 106

Two types of transition were distinguished: the Curie point transition, observed at zero field, is slow; the fast transition occurs only if the electric field is changed faster than ca. 1 kv/cm/sec. The temperature at which the two types of transition occurred was measured as a function of the electric field in both the [100] and [110] directions, and compared with the theoretical predictions.

National Bureau of Standards, Washington, D. C.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 2: THE HEAT CAPACITY OF ANHYDROUS SODIUM HYDROXIDE FROM 0° TO 700°C, by Thomas B. Douglas and James L. Dever. Rept. on Contract AF 33(616) 52-10. Aug 53, 41p. 23 refs. WADC Technical rept. 53-201, pt. 2; AD-18 709.
Order from LC mi$3.30, ph$7.80 PB 138 466

Cryoscopic and enthalpy measurements on 2 NaOH (approximately 99.3% purity) samples sealed in Ag indicated an fp of 317°C and a transition at 293°C. The ΔH between 0°C and 11 temperatures up to 700°C was measured by a drop method and a Bunsen ice calorimeter. Thermal measurements near the fp were used to correct for impurities. The mp and heats of fusion and transition for pure NaOH were 319°C and 159 and 158 abs joules/g, respectively. The results compared favorably with previous values. By employing the corrected enthalpy results together with the Kelly and

Snyder absolute entropy 15.34±0.1 cal/mol-deg K) at 298.2°K, the relative enthalpy and free energy, entropy, and heat capacity were computed and tabulated from 298.2° to 1000°K.

Rensselaer Polytechnic Inst., Troy, N. Y.
ELECTROCHEMISTRY OF MOLTEN ALKALI AND ALKALINE EARTH HALIDES CONTAINING HALIDES OF TITANIUM, by George J. Janz. Final rept. on Contract Nonr-591(06). Oct 57, 16p.
Order from OTS $0.50 PB 151 156

The experimental work was on the constitution and electrochemical properties of the alkali metal titanium fluorides (M_2TiF_6) in the LiCl-KCl eutectic melt in the temperature range 350-450°C, using the techniques of electrical conductance and cryoscopy. The preparation and purification of dry alkali chlorides, the LiCl-KCl eutectic mixture, and the redetermination of the values for the heat and entropy of fusion for the latter were investigated. These studies, together with a literature assessment of current ideas in the field of molten salts, are outlined in this report. (See also PB 126 989, PB 127 141, PB 151 155)

[Research Inst.] U. of Michigan, Ann Arbor.
INVESTIGATION ON THE EFFECTS OF ULTRASONIC ENERGY ON COMBUSTION, by Jay A. Bolt, David H. Holkeboer, and William Mirsky. Final rept. on Contract AF 49(638)180. June 58, 16p. 3 refs. 2634-4-F; AFOSR TR-58-75; AD-158 329.
Order from LC mi$2.40, ph$3.30 PB 138 982

This report covers an investigation of the effect of high-intensity sound fields, in the frequency range of 20 kc to 50 kc, on combustion of natural gas and kerosene. It follows a previous investigation by Mirsky which showed that the presence of ultrasonic energy increases the evaporation rate of fuel drops. Three transducers were developed, two of which were applied to combustion processes. It was noted that ultrasonic energy decreased smoke and carbon formation, apparently increased the burning rate, and increased the tendency for flames to be quenched or extinguished.

Tiltman Langley, Ltd. (Gt. Brit.).
RESEARCH ON STUDY OF THE TURBULENT FLAME PROPERTIES OF ELEMENTARY COMBUSTION CHAMBER FLOW PATTERNS, by A. B. Miller, A. Capella, and D. B. Spalding. Technical scientific note no. 1 on Contract AF 61(514)1213. 24 Feb 58, 66p. 5 refs. AFOSR TN-58-388; AD-154 296.
Order from LC mi$3.90, ph$10.80 PB 136 255

The main purpose was to examine the validity of tracer techniques used in prediction of flame phenomena for combustion-chamber design. The flow behind an axially symmetrical baffle 1.37" dia, 3.88" long with 45° included angle nose cone in a 2.87" duct has been examined at one Reynolds Number with the object of answering some of these questions. The technique was to inject argon steadily at one point, and determine its concentration at another, many pairs of points being considered. The development of the technique and rig is given in detail in the report.

Ultrasonics Research Lab., Western Reserve U., Cleveland, Ohio.
QUANTITATIVE MEASUREMENTS OF IONIC VIBRATION POTENTIALS, by Ernest Yeager, Jonathan Booker, and Frank Hovorka. Technical rept. 19 on Contract N7onr-470(02). Aug 57, 19p. 14 refs.
Order from LC mi$2.40, ph$3.30 PB 135 744

Apparatus is described in this report for the quantitative study of ionic vibration potentials by means of pulse-modulated ultrasonic waves. Results are presented for potassium chloride solutions at various concentrations at frequencies of 200 and 840 kc./sec. and for potassium hydroxide at the latter frequency. These data appear reasonable in terms of theoretical considerations. Ionic vibration potentials are significant as a means for examining the electrostrictive effects of ions on solvent molecules.

University of Southern California, Los Angeles.
FINAL REPT. FOR 1956-1958, ON CONTRACT AF 18(603)122, by H. L. Frisch. Aug 58, 3p. AFOSR TR-58-77; AD-158 344.
Order from LC mi$1.80, ph$1.80

Summary of work on the following subjects: Relaxation Times in Dilute Systems, Phase Transformations in Colloidal Systems, and Gelation Theory.

University of Southern California, Los Angeles.
STUDIES OF THE RARE EARTH HYDRIDES, by James C. Warf and William L. Korst. Technical progress rept. no. 2, 1 Oct 52-15 Nov 53, on Contract Nonr-228(03). 37p. 20 refs. AD-23 188.
Order from LC mi$3.00, ph$6.30 PB 137 676

Cerium hydride dispersions decomposed into hydrogen and cerium amalgams above approximately 115°, and reacted vigorously with water at room temperature. Freezing and cooling curves of uranium hydride and cerium hydride dispersions showed no depression of the freezing point of mercury.

EARTH SCIENCES

Massachusetts Inst. of Tech., Cambridge.
GEOLOGIC AGE DETERMINATION BY THE HELIUM METHOD AND RELATED SUBJECTS, by Patrick M. Hurley. Final rept. on Contract N5ori-078(29). June 57, 49p. 45 refs. AD-133 204.
Order from LC mi$3.30, ph$7.80 PB 135 444

Results of the following studies are discussed: (1) the escape of He from rocks and minerals, (2) radiation damage studies, (3) distribution of U and Th in granitic rocks, (4) direct radiometric analysis of U, Th, and K by scintillation spectrometer, (5) abundance and distribution of U and Th in zircon, sphene, apatite, epidote, and monazite in granitic rocks, (6) the direct measurement of ionium in ocean cores, (7) comparison of He and radiogenic Pb in zircons with low radiation damage, (8) relative ages of eastern Massachusetts granites by total Pb ratios in zircon, (9) research on

the separation of A from other gases, (10) test on the possible chondritic composition of the earth's mantle and its abundance of U, Th, and K, (11) radioactivity of crustal rocks and its relation to the earth's heat balance and the origin of basalt, and (12) discrimination of thoron activity in the presence of radon.

Naval Research Lab., Washington, D. C.
EVIDENCE FOR CORRELATIONS BETWEEN MICROSEISMS AND EARTHQUAKES, by C. A. Nanney. Interim rept. 13 Jan 59, 23p. 12 refs. NRL Rept. 5237.
Order from OTS $0.75 PB 151 170

A study was made to determine whether any correlations exist between the occurrence of earthquakes and the properties of microseisms. Correlations were found between (a) microseism frequency and the occurrence of large earthquakes, (b) microseism amplitudes and the occurrence of large and deep earthquakes, (c) smaller shocks and a local increase of microseism amplitudes, (d) long-period (>10 seconds) microseisms and the occurrence of deep earthquakes, and (e) microseism propagation directions and the great circle path to the location of significant earthquakes. The preceding correlations were all found to test significantly at a 0.01 statistical significance level or greater.

New Mexico Inst. of Mining and Tech., Socorro.
STUDY OF THE ELECTRICAL PROPERTIES OF ICE, by Haro V. Buttlar and E. J. Workman. Rept. for period ending 30 Sep 57 on Contract Nonr-815(01). 15 Oct 57, 31p.
Order from LC mi$3.00, ph$6.30 PB 135 927

E. J. Workman and S. E. Reynolds have discovered that during freezing of a salt solution in water of low concentration, a potential difference, in some cases up to 200 v, is established between the freezing base and the liquid. The voltage obtained is dependent on the species of ions involved, the concentration, and the freezing rate.

Quartermaster Research and Engineering Command, Natick, Mass.
WET TROPICS: LIMITS AND CHARACTERISTICS, by Jack V. Chambers, Paul C. Dalrymple, and Harding Jones. Sep 57, 31p. 25 refs. Technical rept. EP-63.
Order from LC mi$3.00, ph$6.30 PB 135 863

The wet-tropical areas of the world lie between 25°N and 25°S latitudes, and cover about 15 percent of the world's land surface. The wet tropics were analyzed according to three main environmental elements: climate, vegetation, and soil. This report includes 7 photographs of typical tropical vegetation and 20 maps showing the world distribution of elements of tropical environment.

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford, Mass.
SOME CHARACTERISTICS OF TURBULENCE AT HIGH ALTITUDES, by Mariano A. Estoque. Dec 58, 17p. 3 refs. GRD Research Notes no. 4; AFCRC TN-58-624; AD-160 757.
Order from OTS $0.50 PB 151 582

Turbulence data obtained at altitudes of 23,000 to 60,000 feet by the GRD Project Jet Stream and the NACA-AWS groups using instrumented aircraft are analyzed as an initial attempt to construct a synoptic climatology of high-altitude turbulence. Statistical characteristics of turbulence in and outside of the jet stream region are presented. The parameters examined are the horizontal extent of turbulent areas and of the intervening non-turbulent areas, the maximum gust velocity in a turbulent area, and the percentage of flight time in turbulent air.

Air Force Cambridge Research Center, Bedford, Mass.
VENTING OF HOT GASES THROUGH TEMPERATURE INVERSIONS, by Mariano A. Estoque. Dec 58, 16p. 11 refs. GRD Research Notes no. 3; AFCRC TN-58-623; AD-160 756.
Order from OTS $0.50 PB 151 581

The penetration of temperature inversions in the lower atmosphere by plumes of hot air is investigated as part of a safety analysis in the nuclear aircraft program. This problem is studied with the aid of existing theoretical as well as experimental work. A nomogram showing the relationship between the maximum height attained by a hot plume of a given heat source intensity and the temperature gradient of the environment is presented. The limitations of existing knowledge on the problem are pointed out and some recommendations for future research are made.

[Army] Signal [Research and Development] Labs., Fort Monmouth, N. J.
PROCEEDINGS, WEATHER RADAR CONFERENCE [No. 5] AND 139th NATIONAL MEETING OF THE A. M. S. 12 - 15 SEP 55 AT HOTEL BERKELEY CARTERET, ASBURY PARK, N. J., by E. F. Annett, J. T. Plate and others. 17 Oct 56, 314p. 111 refs.
Order from LC mi$11.10, ph$48.60 PB 138 047

Invited papers which were given at the conference are included on the following topics: Signal Corps meteorological instrumentation program, analysis of sferices and its relation to severe thunderstorm phenomena, and the effects of numerical weather prediction on current observing and forestry practices. Papers are also included which were given at the following sessions: hurricanes, atmospheric variability and observational problems, structure and life cycle of storms, reports on operational experiences with weather radar and sferics equipments, use of radar and sferics in analysis and forecasting, meteorological instrumentation, drop-size distribution, and precipitation physics and storm structure.

Bausch and Lomb Optical Co., Rochester, N. Y.
INFRARED HYGROMETER, by Corwin H. Brumley. Final rept. on Item 3, Contract NOas-55-649-d. 4 Dec 56, 69p.
Order from LC mi$3.90, ph$10.80 PB 138 555

The Bausch & Lomb Infrared Hygrometer is an instrument designed to measure the amount of water vapor in the atmosphere. This is accomplished by measuring the absorption of infrared radiation in a water vapor absorption band. A further objective of the instrument was to make the instrument suitable for aircraft operation.

Cloud Physics Lab., U. of Chicago, Ill.
SUMMARY OF STUDIES OF CUMULUS CLOUDS, by H. R. Byers. Final rept. 15 Mar 55-31 Dec 57 on Contract AF 19(604)1388. 31p. 25 refs. AFCRC TR-58-208; AD-146 850.
Order from LC mi$3.00, ph$6.30 PB 136 246

Institute of Mathematical Sciences, New York U., N. Y.
THE NUMERICAL SOLUTION TO THE GEOSTROPHIC CONSERVATION EQUATION, by David A. Levine. Scientific rept. no. 1 on Contract AF 19(604)2265. Apr 58, 26p. 5 refs. IMM-NYU-247; AFCRC TN-58-222; AD-146 874.
Order from LC mi$2.70, ph$4.80 PB 135 961

A solution of the equation is offered as an aid to the problem of predicting the path of large disturbances such as hurricanes. The physical model used is that of a single layer of incompressible, inviscid, homogeneous atmosphere at constant density, with a free surface at a height which includes most of the atmosphere when equivalently reduced to constant density. The height of the free surface is small compared with the average wavelength of large scale disturbances, and hence shallow water, gravity wave approximations can be used. A 2 layer model with a deep layer of less dense warm fluid overlying a relatively thin layer of denser cold fluid is also used. Instead of a spherical ground surface, a plane tangent to the earth is taken with the point of tangency centered at the locale of interest. The derivation of the basic equations is from the shallow water gravity wave equations. An exact solution of these is given by a free surface of constant height and an atmosphere at rest. Because of the slow movement of large scale atmospheric phenomena this basic solution is appropriate for a perturbation expansion. The quantities used are the first order terms of a perturbation on this state of rest. The resulting equations for the first order terms of the perturbation expansion are a nonlinear set and are called, collectively, the geostrophic conservation equation.

Massachusetts Inst. of Tech., Cambridge, Mass.
WEATHER RADAR RESEARCH. Progress rept. no. 11, 1 Jan-28 Feb 53, and Final rept. 1 July 50-28 Feb 53. 24p. on Contract DA 36-039-sc-124; Continuation of Contract W36-039-sc-32038.
Order from LC mi$2.70, ph$4.80 PB 136 015

The aims of this research are to learn more about the fundamental nature of radar echoes from weather phenomena, to interpret the radar information in meteorological terms, and to exploit the uses of radar in meteorological research.

Pennsylvania State U. Mineral Industries Experiment Station, University Park.
LARGE-SCALE VERTICAL MOTION AND WEATHER DURING A WINTER AND SUMMER PERIOD, by Robert C. Curtis and Albert Miller. Final rept. on Contract AF 19(604)1025. 1 Sep 57, 68p. 2 refs. Mineral Industries Experiment Station no. D-47; AFCRC TR-57-224; AD-133 814.
Order from LC mi$3.90, ph$10.80 PB 132 794

This report presents the results of a study of the effects of vertical velocity and other predictors on probability of cloudiness and precipitation for January, 1953 and July 1-20, 1955. Many different techniques were used to estimate the field of vertical motion. In winter, all gave comparable results. In summer, only the kinematic technique with its strong diurnal variation accounts well for the features of the precipitation pattern, particularly the nocturnal maximum in the northern Midwest. Estimates of errors were made of the different techniques; the standard error of a single kinematic observation is about 1.4 cm/sec, and about 0.9 cm/sec for the computations by methods of numerical weather prediction.

Quartermaster Research and Engineering Center, Natick, Mass.
WINTER WEATHER TYPE FREQUENCIES, NORTHERN GREAT PLAINS, by Wesley Calef, Melvin Lackey and others. Aug 57, 277p. 87 refs. Technical rept. EP-64.
Order from LC mi$9.90, ph$34.80 PB 136 211

A system was devised for the classification of combinations of weather elements into standard weather-type days. Ten-year records for the winter at 16 Great Plains stations were examined, and each day was classified according to the system. The classification system involves five weather elements, temperature, precipitation, wind speed, relative humidity, and sky cover, with a total of 1200 possible combinations. The stations were analyzed, however, without regard for precipitation, thus reducing the number of possible weather types to 600. Frequency of occurrence of the various weather types on a monthly and seasonal basis over the ten-year period are tabulated for four stations, Cheyenne, Wyo., Bismarck, N. Dak., Havre, Mont., and Huron, S. Dak.; other stations in the Great Plains receive somewhat briefer treatment.

[Research Inst.] U. of Michigan, Ann Arbor.
DISPERSION AND PENETRATION OF POLLENS AND INDUSTRIAL CONTAMINANTS, by E. Wendell Hewson and A. Nelson Dingle. Final rept. for 16 June 53-15 Dec 55 on Contract AF 19(604)792. Oct 56, 104p. 10 refs. Rept. no. 2160-11-F; AFCRC TR-56-290; AD-98 739.
Order from LC mi$5.70, ph$16.80 PB 137 650

The analysis first discusses the influence of extraneous forces, fluid resistance, and fluid inertia, and then relates these quantities in a stochastic differential equation. The mathematical representation of the turbulent velocity field is next developed in terms of the spectrum density and autocorrelation functions. With certain simplifying assumptions the particle equation is solved by use of Wiener's generalized harmonic analysis. Particle dispersion and probability distributions are next analyzed and the treatment concluded with an illustrative example using a prescribed form for the spectrum density and an indication of practical applications of the theory. The discussion of the main experimental program is preceded by brief descriptions of clinical studies of ragweed-pollen allergy, using project equipment, and of a survey of meteorological instrumentation of the type used in the field experimentation.

Geodesy

Aerial Reconnaissance Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EVALUATION OF TWELVE-INCH TRIMETROGON PHOTOGRAPHY BY RADIAL TRIANGULATION TEST, by Leon J. Kosofsky. Rept. on Techniques for Aeronautical Charting. June 56, 29p. 1 ref. WADC TR-56-286; AD-102 822.
Order from LC mi$2.70, ph$4.80 PB 137 202

An evaluation of the results of tests made to determine the usefulness of one arrangement of aerial cameras, with wide-angle lenses of twelve-inch focal length, for the compilation of aeronautical charts is presented. The tests made on the system, known as the twelve-inch trimetrogon system, measured the accuracy with which radial triangulation could be performed. Forty-seven check points were located by radial triangulation, with a mean square error of 1100 feet. It was concluded that twelve-inch trimetrogon photography can be successfully used for chart compilation, but that it is, in general, less desirable than the usual (six-inch) trimetrogon photography.

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODETIC DATUMS AND AN ESTIMATE OF THEIR ACCURACY, by Bela Szabo and William Mussetter. Apr 53, rev. Nov 56, 32p. ACIC Technical rept. no. 24(Rev.)
Order from LC mi$3.00, ph$6.30 PB 138 330

It is the purpose of this paper to give a general review and the present status of the horizontal and vertical datums; to present the methods which are or can be used to establish connections, and to furnish an estimate of the discrepancies between existing major datums as is possible with the information at hand. The principal interest focuses on the North American, European and Russian datums and brief histories of their developments will be given.

Oceanography

Navy [Electronics] Lab., San Diego, Calif.
BATHYTHERMOGRAPH SIMULATOR. Rept. on Contract NObs-2074 (formerly OEMsr-30). 13 Sep 45, declassified. 41p. [U-360].
Order from LC mi$3.30, ph$7.80 PB 139 047

The device is an adjunct to the Askania Diving Trainer and, as installed, became a component of the Trainer in use at the Repair Base, San Diego. The purpose of the Simulator is to introduce automatically into the Askania Trainer the changes in water density as a function of depth that are caused by any specified temperature gradient, and to trace on the card of a Submarine Bathythermograph mock-up the corresponding depth-temperature curve. Any desired depth-temperature pattern may be recorded on master cards for reproduction in the Bathythermograph Simulator by photoelectric scanning. Only one unit of the Bathythermograph Simulator was built. It is understood that the Bureau of Ships has made provision in forthcoming models of the Askania Trainer for the inclusion of a similar feature.

Washington U., Seattle.
NORTHEAST PACIFIC OCEAN PHYSICAL AND CHEMICAL DATA, SUMMERS OF 1955 AND 1956: PRELIMINARY TABULATION OF OCEANOGRAPHIC DATA COLLECTED BY M. V. BROWN BEAR AND M. V. JOHN N. COBB, by Cuthbert M. Love. Rept. on Contracts Nonr-477(10), Nonr-477(01), F&WS 14-19-008-2429, and F&WS 14-19-008-2369. Aug 57, 110p. 5 refs. Dept. of Oceanography Technical rept. no. 55; Ref. 57-27.
Order from LC mi$5.70, ph$16.80 PB 135 873

This report presents physical and chemical data. Charts show the positions of the stations sampled. Values are given for temperature, salinity, density, dissolved oxygen, and dissolved inorganic phosphate for selected depths from surface to bottom.

Woods Hole Oceanographic Institution, Mass.
EFFECT OF WINDS ON COASTAL WATER LEVELS OF NEW ENGLAND, by Arthur R. Miller. Final rept. on Contract Cwb-8630, Technical rept. on Contract Nonr-2196(00). Mar 57, 35p. 7 refs. Ref. no. 57-22.
Order from LC mi$3.00, ph$6.30 PB 136 126

Woods Hole Oceanographic Institution, Mass.
EXPERIMENTAL PHYSICAL OCEANOGRAPHY, by C. O'D. Iselin. Technical rept. 1 Jan-31 Aug 57 on Contract Nonr-1831(00). 37p. Ref. no. 57-47.
Order from LC mi$3.00, ph$6.30 PB 136 117

Contents
Studies of the ocean circulation
Studies of the atmospheric circulation
Studies of thermal convection
Optics for meteorological research

Physics of the Atmosphere

Ballistic Research Labs., Aberdeen Proving Ground, Md.
STEREOSHADOWGRAM EXPERIMENTS IN THE LOWER ATMOSPHERE, by P. F. Gott. Aug 58, 23p. 3 refs. Memo. rept. no. 1165.
Order from LC mi$2.70, ph$4.80 PB 136 759

A study of some of the light transmission characteristics of the air has been made, using a double source of light and an image slicer to enable the shadowgrams due to each source on the telescope objective to be studied. The study included experiments involving intermittent light (less than 50 microseconds duration at rates to 30 times per second) on continuously moving film. Other experiments involved a continuous source of light and intermittently exposed film.

Naval Research Lab., Washington, D. C.
ATMOSPHERIC RADIOACTIVITY STUDIES AT THE U. S. NAVAL RESEARCH LABORATORY, by L. B. Lockhart, Jr., R. A. Baus, and others. Interim rept. 19 Dec 58, 15p. 3 refs. NRL Rept. 5249.
Order from OTS $0.50 PB 151 271

This report, presented at the Chicago meeting of the American Chemical Society (September 1958), summarizes the information obtained since 1948 relative to the levels of some of the principal radioactive constituents of the normal atmosphere and traces the long-term changes that have occurred in the fission product concentration in the air at a number of sites in the Northern Hemisphers. Since the start of the IGY program much information has become available in gross fission product levels at various sites along the 80th meridian (west) from Antarctica to Greenland. Radiochemical analysis of material from the various collecting sites has resulted in considerable information on the air concentration of such long-lived radioisotopes as Ce^{144}, Sr^{90}, Cs^{137}, and Pb^{210} and on "stratospheric holdup," which is confirmed by the presence at all collecting sites of unusually high percentages of the long-lived radioactive material from past large-yield nuclear explosions. At no place studied, however, does the fission product concentration add any significant amount to the total radioactivity of the air.

[Norden Labs. Corp.] White Plains, N. Y.
CORRELATION OF DATA CONCERNING VISIBLE AND NEAR INFRARED RADIATION FROM THE NIGHT SKY. Final rept. on Contract AF 18(600)1746. 20 Aug 57, 61p. 22 refs. Rept. 152 R 0001; AD-142 761.
Order from LC mi$3.90, ph$10.80 PB 136 295

ENGINEERING

Applied Mathematics and Statistics Lab., Stanford U., Calif.
SOME TESTS BASED ON THE FIRST r ORDERED OBSERVATIONS DRAWN FROM AN EXPONENTIAL DISTRIBUTION, by Benjamin Epstein and Milton Sobel. Stanford U. Technical rept. no. 6 on Contract N6onr-251(26) and Wayne U. Technical rept. no. 1 on Contract Nonr-451(00). 1 Mar 52, 52p. 5 refs. ATI-154 899.
Order from LC mi$3.60, ph$9.30 PB 137 252

The principal objective is to study statistical problems which arise when the observations become available in an ordered manner. Usually observations made on a random variable do not become available in this way.

Office of Scientific Research and Development. Div. 9.
TETRAMETHYLDIAMINOTHIOBENZOPHENONE COLOR TESTS WITH CW AGENTS, by Weldon G. Brown and R. G. Denkewalter (Toxicity Lab., U. of Chicago) Informal rept. no. 80 on Contract OEMsr-79. 15 July 43, declassified 10 Aug 56, 7p.
Order from LC mi$1.80, ph$1.80 PB 136 114

Tetramethyldiaminothiobenzophenone reacts with all the common CW agents (except HCN and arsine) to give a blue or green color, either directly, or in the case of the mustards, on heating. The sensitivity is excellent, but the reagent is too unstable for use in prepared tubes. It may be of value in the field laboratory as a screening test to provide a quick differentiation of toxic and non-toxic agents.

Aeronautical Engineering

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ALUMINUM TUBING REQUIREMENTS FOR AIRCRAFT LIQUID OXYGEN SYSTEMS, by Curtis A. Gibson. Feb 57, 18p. WADC TR-57-73; AD-118 031.
Order from LC mi$2.40, ph$3.30 PB 137 011

Tests were conducted to determine temperatures at various distances from liquid oxygen converters in warming vaporized liquid oxygen by means of passage through several types of aluminum tubing. It was found that, generally, less plain aluminum tubing was required than alumalized tubing. Heat transfer was more efficient through straight tubing than through tubing coiled around the converter.

Air Products, Inc., Allentown, Pa.
RECHARGER UNIT, LIQUID NITROGEN OR OXYGEN, HEAT CONVERSION METHOD TYPE XMA-1, by S. L. Feldhan. Final technical rept. on Contract AF 33(600)27333. Jan 57, 70p. WADC Technical rept. 57-382; AD-130 827.
Order from LC mi$3.90, ph$10.80 PB 136 483

The report includes a general discussion depicting the design and operating characteristics of the major components. Material and heat balances and mechanical performance have been calculated on the basis of theory as well as experimentally. Test procedures and data for operation with liquid oxygen and liquid nitrogen are summarized in their respective log sheets.

Aircraft Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PRESSURE LOSSES ACROSS SCREENS AND GRIDS, by S. F. Hoerner. Rept. on Air Induction Systems: Power Plant. Nov 50, 28p. 11 refs. AF Technical rept. no. 6289; ATI-128 686.
Order from LC mi$2.70, ph$4.80 PB 139 029

The existing theoretical and experimental material on screens and grids is reviewed in this report. The principal findings are as follows: (a) Wire screens with higher solidities show a pressure loss according to the Borda-Carnot principle. This is because of the sudden expansion of cross-section area behind the screen elements. (b) In the region of low solidities pressure loss across screens and grids corresponds to the free-flow drag coefficient of the respective elements, and to the average increased dynamic pressure within the openings. (c) By arranging screens or grids in an inclined or staggered position, their pressure loss can be appreciably reduced. About the same reduction can be accomplished by placing the screen into an expanded cross section of the respective duct. (d) Because of compressibility, the pressure loss of screens and grids increases steadily up to the critical or choking Mach number. In this limiting case the loss coefficient of wire screens is between 1.4 and 2 times as high as under incompressible conditions.

American Power Jet Co., Ridgefield, N. J.
POTENTIAL AIRCRAFT ICING PROBABILITIES IN THE NORTHERN HEMISPHERE, by Robert W. Jailer. Rept. on Operations Analysis of Icing Problems, Contract AF 33(616)2605. Nov 56, 53p. 116 refs. WADC Technical rept. 56-659; AD-110 676.
Order from LC mi$3.60, ph$9.30 PB 137 304

Eight charts outlining the probability of potential icing conditions for aircraft operating in the Northern Hemisphere are presented. The figures presented on the charts are best interpreted as the potential icing probability for low speed, thick-wing aircraft, as exemplified by the B-29, at a given point. For use with high-speed, thin-wing aircraft, due allowance must be made for the aircraft ice collection characteristics. The probability figures developed are compared with statistical data on the incidence of aircraft icing for those few cases in which such data could be located. When the differences between the data bases are considered, the calculated probabilities are found to be in reasonable agreement with the observed frequencies.

Armour Research Foundation, Chicago, Ill.
STUDY OF VIBRATION AND SHOCK IN AIRCRAFT AND DEVELOPMENT OF INSTRUMENT MOUNTINGS, by Edgar H. Fey and Robert O. Loving. Interim rept. no. 1 on Phase 1, 1 Mar 57-15 Feb 58, Contract AF 33(616)5033. 72p. 20 refs. WADC Technical rept. 58-148; AD-151 128.
Order from OTS $2.00 PB 151 540

A survey of aircraft shock and vibration environmental conditions was conducted for purposes of defining the environment in which aircraft flight control instruments must operate. The survey covered instrument and instrument mount manufacturers, scientific laboratories and government agencies, and aircraft and missile manufacturers. In addition to collecting data, related problems were discussed with personnel of most of the organizations surveyed. It was generally agreed that the present vibration test procedure which flight control instruments must withstand (Procedure I of Specification MIL-E-5272A) is too severe for the following reasons: (1) Flight control instruments usually are mounted in central fuselage areas, while the test procedure is based upon the over-all vibration envelope of the aircraft; (2) transient and short-duration vibration conditions are weighted equally with steady-state conditions; and (3) resonant responses during the discrete frequency sinusoidal excitation of the specification test procedure may be significantly greater than responses to actual environments of the same nominal level. Data collected during the survey are summarized herein and are considered with respect to the first two factors listed above. Evidence is presented to show that, for the locations in manned aircraft where flight control instruments are normally mounted, the current vibration test specification of MIL-E-5272A is twice as severe as required. Two exceptions are noted. The third factor is being investigated by means of an analog analysis. Results of this analysis will be used to establish the vibration test requirements required for the design of instrument mountings.

Bell Aircraft Corp., Buffalo, N. Y.
PREPARATION OF "STRENGTH SUMMARY AND OPERATING RESTRICTIONS" REPORTS, by Robert Goldin and Edward T. Ronan. Rept. for Mar 55-Mar 56 on Research and Study Concerning The Most Feasible Method of Determining and Presenting a Strength Summary and Operating Restrictions Report, Contract AF 33(616)3420. 1 May 57. 66p. 9 refs. WADC Technical rept. 57-162, AD-118 326.
Order from LC mi$3.90. ph$10.80 PB 137 013

A format, with detailed discussions, examples and illustrations, is provided in order that aircraft contractors can more easily prepare satisfactory and usable strength summary and operating restrictions reports. A review of all strength reports from various contractors reveal a lack of uniformity as well as an inadequate quantity of structural information.

Boeing Airplane Co., Seattle, Wash.
BRAZING HONEYCOMB CORE TITANIUM PANELS, by Cyrus S. Noritake and Gerald R. Grow. Final rept for 11 June 56-11 Apr 57 on Construction Techniques and Applications of New Materials, Contract AF 33(600)32686. June 57, 72p. WADC TR-57-292; AD-118 276.
Order from OTS $2.00 PB 151 116

Final report on the development of fabrication techniques for brazing titanium skins to honeycomb cores of both 17-7PH steel and titanium to form sandwich panels capable of operating in temperature environments up to 700°F. Twelve silverbase alloys were investigated for joining skins of 6A1-4V titanium alloy to 17-7PH core and to unalloyed titanium core. The alloy selected for process development work was a 97% silver - 3% lithium. Thirty 3" x 8" all-titanium panels were brazed and destructively tested in beam-shear and in short-column at temperatures of ambient, 500°F, and 700°F.

Cleveland Pneumatic Tool Co., Ohio.
THE DESIGN, ANALYSIS, AND TEST OF HIGH INFLATION PRESSURE SHOCK ABSORBERS, by Robbins R. Bosworth. Rept. for 23 Apr 55-16 Aug 56 on Design of Shock Struts Utilizing Higher Air Pressures, Contract AF 33(600)29626. Oct 56, 97p. WADC Technical rept. 56-563; AD-110 515.
Order from LC mi$5.40, ph$15.30 PB 136 468

The design and analysis of two higher than normal inflation pressure aircraft shock absorbers is presented along with similar information for the production type B-36 shock absorber with which performance of the high pressure units is compared. The shock absorption characteristic of the three designs is compared by drop testing each over a wide range of drop weights and contact velocities. Test data, including drop test oscillograph records, are shown for each test drop. Performance tests, consisting of 300 drops, were conducted on each of the two high-pressure units to evaluate the seals, one of which was of a special high pressure design. No leakage was observed. It is concluded from the results of the testing that the use of pin ended air-oil shock absorbers designed for static inflation pressures up to 8000 psi is practicable.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF IMPROVED MATERIALS FOR AIR SUPPORTED RADOMES, by Walter W. Bird and Norman E. Wahl. Final engineering rept. on Contract AF 28(099)388. 30 Apr 53, declassified 5 May 55, 78p. Rept. no. UB-765-D-4; AD-18 692.
Order from LC mi$4.50, ph$12.30 PB 137 379

A survey was made of new fabrics and coatings and new methods of construction suitable for use in air supported radomes. The study of camouflaging materials was continued and test results on the most satisfactory materials included in this investigation are summarized.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
INVESTIGATION OF THE COMPRESSIVE, BEARING, AND SHEAR CREEP-RUPTURE PROPERTIES OF AIRCRAFT STRUCTURAL METALS AND JOINTS AT ELEVATED TEMPERATURES, by Luke A. Yerkovich. Rept. for 1 May 57-30 Apr 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3456. Dec 58, 97p. 7 refs. WADC Technical Rept. 54-270, Part 5; AD-206 661.
Order from OTS $2.00 PB 151 561

This report summarizes in tabular and chart form the high temperature properties of PH15-7 Mo stainless steel and 6A1-4V titanium alloy in tension, compression, bearing, and shear. In addition, correlations of the tensile creep-rupture properties with corresponding compression, bearing, and shear creep-rupture properties are presented. The creep-rupture characteristics of doubler type riveted joints, which represent single units of a multiple riveted assembly, prepared from the test alloys are presented herein. Correlations between measured joint creep-rupture and predicted joint creep-rupture are also included.

Directorate of Flight and All-Weather Testing, Wright-Patterson AFB, Ohio.
FLIGHT TESTS OF THE CABIN CONDITIONING SYSTEM OF THE B-47B AIRPLANE, by Thomas P. Dallow. 11 Mar 54, 233p. Technical note WCT 54-4; AD-27 939.
Order from LC mi$10.20, ph$36.30 PB 136 410

Flights at medium and high altitudes were made to test the effectiveness and stability of the cabin air heating and cooling system installed in the B-47B airplane. Modifications, made to the pilot's and co-pilot's upper air outlets to provide more controllable flow and the addition of a heater in the navigator's lower air outlet plus insulation over his floor, resulted in increased comfort for all crew members. The addition of a small blower provided for greater air movement over the cabin temperature sensing element, less control lag and better control stability. Also included are the results of heat balance tests made to determine the capacities of the heating and cooling systems as they compare with the design values.

Engineering Div., [Air] Materiel Command [Wright-Patterson AFB, Ohio]
ELECTRONIC TRUE AIRSPEED, by R. D. Munnikhuysen. Rept. on study by Cook Research Labs., Contract W33-038-ac-16653. 28 Jan 48, 15p. Serial no. MCREXE-655-1553A; AD-120 865.
Order from LC mi$2.40, ph$3.30 PB 137 386

To report on the results of a study made by the Cook Research Laboratories, Chicago, Illinois, to determine the practicability of measuring the true airspeed of aircraft by means of ionizing a column of air by an electric discharge and detecting the ionized column at a measured distance downstream.

Flight Control Lab., Wright Air Development Center Wright-Patterson AFB, Ohio
THE AIR FORCE INTEGRATED FLIGHT INSTRUMENT PANEL, by Constantine Svimonoff. Oct 58, 163p. 12 refs. WADC Technical rept. 58-431; AD-155 788.
Order from OTS $3.00 PB 151 541

With the conclusion of the developmental flight test phase of the Air Force Integrated Flight Instrument Panel, two separate reports, covering individually the flight test results obtained by the Flight Test Directorate of the Wright Air Development Center and those obtained by the Air Proving Ground Center, are available. These comprehensive reports represent the formal Air Force flight evaluation of this system. In addition to the flying time covered by these reports, considerable flight experience has been accrued on the system, both in its breadboard stage (Phase I) and final development stage (Phase II), in informal evaluations and flight demonstrations by key Air Force personnel, representative pilots of using commands, the Army, the Navy and Royal Air Force and airframe and equipment industry test pilots. Further, the associated development programs have yielded a wealth of technical information. This report summarizes, correlates and analyzes the knowledge obtained to date from the total flight experience on this panel as well as on related new instruments and instrument

systems. Production implementation of recommended improvements is defined. Areas of primary consideration associated with present and future production and product improvement programs are designated. Special attention is given to the overall problem of incorporation of such panels into particular weapon systems and recommended approaches are indicated.

Goodyear Aircraft Corp., Akron, Ohio
DEVELOPMENT OF A ONE-PIECE PLASTIC WINDSHIELD FOR HIGH-SPEED AIRCRAFT, by Rolland D. Huff, Stanley C. Patrick, and Charles R. Frownfelter. Rept. on Contract AF 33(600)26721. June 55, 83p. 21 refs. WADC Technical note 55-241, pt. 1; AD-92 970.
Order from LC mi$4.80, ph$13.80 PB 139 037

The investigation of one-piece plastic windshield for high-speed aircraft was the object of this research. Studies were conducted on materials, loads, temperatures, and stresses for both single wall and double wall windshields. Included in the studies is an investigation of temperature gradients and thermal stresses corresponding to a diving flight path. Optical tests were performed on laminated plastic panels formed to the contour of the hypothetical windshield. This report also contains preliminary design drawings for double wall and single wall windshields. Large positive air loads, high windshield temperatures, and thermal gradient stresses make potential buckling of the windshield panels a critical design condition. The optical tests show that the distortion specification (variation in deviation) will be the most difficult requirement for a laminated plastic windshield to satisfy, and indicates the necessity of additional study on this problem. It is concluded that a one-piece plastic windshield is structurally feasible and merits further development.

Goodyear Aircraft Corp., Akron, Ohio
DEVELOPMENT OF A ONE-PIECE PLASTIC WINDSHIELD FOR HIGH-SPEED AIRCRAFT, by Richard H. Hassard and Duane C. Shearer. Rept. on Contract AF 33(600)26721. July 57, 77p. 7 refs. WADC Technical note 55-241, pt. 2; AD-130 961.
Order from LC mi$4.50, ph$12.30 PB 139 035

A one piece, double wall, plastic windshield was developed to and including the point of preliminary design drawings in the first phase of this program as reported in WADC TN 55-241 Part I. The second phase of the program is reported herein and includes the final design, construction, and testing of a one piece, double wall windshield. Optical tests indicated that the assumed 30^{o} windshield installation angle caused angles of incidence to the pilot's line of sight which were beyond a practical limit in the forward and aft corners of the windshield. Environmental tests were successfully performed which simulated buckling air loads at extreme temperature conditions on the windshield. The 1000 cycle fatigue test was successfully performed which simulated buckling loads which would recur for repeated take-offs or bursts of speed. The windshield successfully withstood buckling loads up to 15 psi on the inner wall. It is concluded that the one piece windshield is structurally practical, but that the 30^{o} installation angle will restrict the usable optical area.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY. PART 5. SOME EXPERIMENTAL DATA FOR UNIFORMLY THIN SWEPT RECTANGULAR CANTILEVER PLATES OF LOW ASPECT RATIO, by M. L. Williams. Rept. for Apr 50-June 50 on Contract W33-038-ac-16961. Oct 50, 29p. 5 refs. AF Technical rept. 5761, pt. 5; ATI-89 420.
Order from LC mi$2.70, ph$4.80 PB 136 198

In order to examine the rate of convergence of an approximating series, consisting of products of the modes of vibrating beams, to the function representing the deflection of a low aspect ratio thin swept cantilever plate, an experimental program was set up to test a uniformly thin swept rectangular cantilever plate at sweep angles up to 60 degrees under three loading conditions, namely, tip shear, uniformly distributed normal load, and tip torque.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON THE STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY, PART 8. SOME EXPERIMENTAL DATA ON THE DEFLECTION AND ROOT STRESSES IN A CANTILEVER TRIANGULAR PLATE OF CONSTANT THICKNESS WITH VARYING TRAILING EDGE SWEEP ANGLE, by G. M. Hrebec. Rept. for Apr 47-June 49 on Contract W33-038-ac-16961. Nov 50. 51p. 3 refs. AF Technical rept. 5761, pt. 8; ATI-89 753.
Order from LC mi$3.60, ph$9.30 PB 136 241

With the advent of tapered, swept, thin wings of high solidity, existing methods of stress and loads analysis have become inadequate. Research was carried out at the Guggenheim Aeronautical Laboratory of the California Institute of Technology to investigate the effects of sweep upon the deflection and stress patterns of wings of high solidity. This report attempts to give designers basic information on the stresses and deflections that may be encountered in surfaces having a triangular planform. The stresses have been normalized, and the deflections are given as influence coefficients.

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
THEORETICAL AND EXPERIMENTAL EFFECT OF SWEEP UPON THE STRESS AND DEFLECTION DISTRIBUTION IN AIRCRAFT WINGS OF HIGH SOLIDITY. PART 14. ERRATA AND REVISIONS, by E. E. Sechler. Rept. for Apr 47-June 49 on Contract W33-038-ac-16961. Nov 50, 41p. AF Technical rept. 5761, pt. 14; ATI-89 717.
Order from LC mi$3.30, ph$7.80 PB 136 202

With the advent of tapered, swept, thin wings of high solidity, existing methods of stress and loads analysis have become inadequate. Research was carried out at the Guggenheim Aeronautical Laboratory of the California Institute of Technology to investigate the effects of sweep upon the deflection and stress patterns of wings of high solidity. This report is essentially a

summary of the errata and desired changes in AF Technical Report 5761 - Parts I to XIII inclusive.

Lockheed Aircraft Corp., Marietta, Ga.
FEASIBILITY STUDY: EXPENDABLE TYPE PLATFORMS FOR LOW COST AERIAL DELIVERY BY PARACHUTE, by Merle C. Madaffer and Charles Buhman. Rept. for 5 July 56-2 Aug 57 on Dual Rail Aerial Delivery System, Contract AF 33(616)3792. Aug 57, 175p. 11 refs. WADC Technical rept. 57-403; AD-130 989.
Order from LC mi$8.10, ph$27.30 PB 138 667

All phases of aerial delivery operations have been studied to determine what factors influence the cost of delivery of vehicles, weapons, and other heavy equipment by parachute. Those factors wherein a savings over the present system can be effected are further studied to determine the optimum system. Load combinations, platform sizes, materials, methods of construction, shock absorption methods and anti-toppling devices are analyzed. Platform configurations which offer the lowest cost for the overall aerial delivery operation are presented.

Michigan U., Ann Arbor.
COORDINATE SYSTEMS FOR SOLVING THE THREE-DIMENSIONAL FLIGHT EQUATIONS, by R. M. Howe. Rept. on Contract AF 33(616)2839. June 56, 51p. 3 refs. WADC Technical note 55-747; AD-111 582.
Order from LC mi$3.60, ph$9.30 PB 139 053

The choice of coordinate systems and the methods of coordinate resolution are extremely important in designing the computer section of flight simulators. In this report the six-degree-of-freedom flight equations are presented in the body-axis system, and the general equations for aerodynamic forces and moments are given. Next, the six-degree-of freedom flight equations are rederived, using wind axes for the three translational degrees of freedom. Finally, the alternative use of body-axis Euler angles, wind-axis Euler angles, or direction cosines for coordinate transformations is discussed. It is concluded that the combined coordinate system which uses wind axes for translational and body axes for rotational equations is the best. Choice of coordinate transformation methods depends on the requirement of the simulation. Example computer circuits and recordings of computer solutions for the F-86 D are presented.

National Advisory Committee for Aeronautics, Washington, D. C.
EFFECT OF ADVANCE RATIO ON FLIGHT PERFORMANCE OF A MODIFIED SUPERSONIC PROPELLER, by Jerome B. Hammack and Thomas C. O'Bryan. Sept. 58, 20p. 2 refs.
Order from NASA NACA TN-4389

Results of a flight investigation of a modified supersonic propeller at the design Mach number of 0.95 indicated a propeller efficiency of approximately 79 percent. The departure from optimum angle of advance has a small effect for the advance ratios investigated.

National Advisory Committee for Aeronautics, Washington, D. C.
USE OF THE COANDA EFFECT FOR JET DEFLECTION AND VERTICAL LIFT WITH MULTIPLE-FLAT-PLATE AND CURVED-PLATE DEFLECTION SURFACES, by Uwe H. von Glahn. APPENDIX B: ESTIMATED PERFORMANCE OF MULTIPLE-FLAT-PLATE DEFLECTORS, by Thomas F. Gelder. Sep 58, 54p. 4 refs.
Order from NASA NACA TN-4377

Deflectors consisting of two, three, six, and nine flat plates and curved plates, all using the Coanda effect for achieving jet deflection and lift, were tested in quiescent air. Ratios of lift to undeflected thrust somewhat less than those theoretically calculated for multiple-flat-plate and perfect curved-plate mechanical deflectors were obtained for the Coanda nozzles. With a 90^{o} deflection of the jet stream, ratios of lift to undeflected thrust near 0.88 for a configuration using nine flat plates and near 0.81 for a curved-plate configuration were obtained together with zero axial thrust.

Naval Ordnance Test Station, China Lake, Calif.
EQUATIONS FOR DETERMINING AN AIRCRAFT'S FLIGHT PATH FROM DATA COLLECTED IN THE AIRCRAFT ITSELF, by Allen Silverman. 10 Dec 57, 35p. NOTS-1895; NAVORD rept. 5815; AD-154 549.
Order from LC mi$3.00, ph$6.30 PB 138 114

A method for determining the flight path of an aircraft using data collected in the aircraft itself is presented in this report. Derivations of the pertinent equations are also given.

Naval Ordnance Test Station, China Lake, Calif.
INTERNAL BALLISTIC DESIGN AND TRAJECTORY ANALYSIS OF A ROCKET-ASSISTED PILOT EJECTION SEAT, by James L. Bray. Rept. for Jan-Aug 57. 17 Oct 57, 26p. NOTS 1701; NAVORD rept. 5433.
Order from LC mi$2.70, ph$4.80 PB 137 459

The problem of safe escape of a pilot from a disabled plane is discussed in general, and a rocket-assisted ejection seat is considered as a solution. Two tentative internal ballistic designs are presented. Equations are developed for the motion of an ejection seat after it leaves the plane. Graphs are included showing thrust-time curves, seat trajectories, forces on the pilot, aerodynamic drag, and physiological acceleration limits.

New York U. Coll. of Engineering, N. Y.
PHOTO-THERMOELASTIC INVESTIGATION OF I-BEAMS, by Herbert Tramposch and George Gerard. Rept. on Contract AF 18(600)1471. Jan 58, 29p. 5 refs Technical rept. SM 58-1; AFOSR TN-58-70; AD-AD-148 113.
Order from LC mi$2.70, ph$4.80 PB 137 975

In this report the photo-thermoelastic technique is further investigated by extension of methods developed for simple rectangular beams to more complex shapes representative of an airframe. In particular, this investigation is concerned with transient thermal

stresses in I beams produced by a temperature differential suddenly applied at top and bottom surfaces of the beam. The test data are correlated with theory using the material properties of the model material previously obtained by calibration and the measured temperature distribution over the cross section. The report also describes in detail the instrumentation developed for the rapid measurement of transient temperatures. As a generalization of the test data, the maximum stresses are shown graphically in nondimensional form.

Ohio State U. Research Foundation, Columbus.
PREDICTED AND EXPERIMENTAL STRESSES IN SIMULATED SOLID PROPELLER BLADES, by C. T. West, E. C. Clark and others. Technical rept. no. 2 on Propeller Blades (Final rept. pt. 2), Contract AF 33(616)2124. [1955] 506p. WADC Technical rept. 55-122, pt. 2; AD-130 783.
Order from LC mi$11.10, ph$77.40 PB 137 276

Stresses and twist angles predicted by the theory developed in Technical Note WCNB 52-3 and in WADC Technical Report 53-20 tested in actual test situation at full scale. 32 simulated propeller blade models of varying chord, thickness, cross section, and angle of pretwist; detailed information on the second eleven specimens. An attempt was made to plot edge and center stresses against twisting moments, in which it was quickly obvious that stresses due to tension and bending were not zero, and hence could not be superimposed on the stresses due to torsion alone and still check a curve developed for the torsion case.

Propeller Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ANALYSIS OF THE REPEATABILITY OF DATA FROM THE WADC-CAL PROPELLER DYNAMOMETER FACILITY, by James C. O'Hara. May 57, 36p. WADC Technical rept. 56-648; AD-138 593.
Order from LC mi$3.00, ph$6.30 PB 138 668

A method is presented for predicting the repeatability of test data to enable a judicious selection of test conditions in planning experimental programs and to give an insight into any limitations of the test data.

Purolator Products, Inc., Rahway, N. J.
EVALUATION OF LOW PRESSURE AIRCRAFT FUEL FILTERS, by C. Casaleggi, E. Ludvig, and H. L. Forman. Rept. on Aircraft Fuel and Propellant Filters, Contract AF 33(616)129. Sep 53, 130p. 5 refs. WADC Technical rept. 55-317; AD-95 414.
Order from LC mi$6.30, ph$19.80 PB 137 832

Several models of 25 and 40 micron (nominal) surface sieving (paper, mesh and metal edge) type of low pressure aircraft fuel filters were developed. These filters were designed to flow 10 GPM and maintain a maximum pressure drop of 8" mercury while servicing that quantity of fuel used in 25 hours at rated flow of the filter, contaminated with 8 grams per 1000 gallons of A. C. Test Dust (Coarse Grade). Extensive laboratory qualification tests were conducted, with particular consideration being given to the following: (1) Filtration efficiency with graduated vitreous spheres to determine the degree of filtration. (2) A method of grading vitreous spheres into size ranges practical and efficient to use. (3) Filtration capacity and cleanability. (4) Water separation. (5) Relief valve characteristics. (6) Accelerated corrosion test. (7) Water resistance. (8) Filter rigidity. A grade of low pressure drop filter paper was studied which may be used over and over again and, while of lower tear and abrasion strength than the wire meshes, exhibits sufficient strength and is much cheaper.

Quartermaster Research and Engineering Center, Natick, Mass.
BASIC CONCEPTS ON THE ENERGY DISSIPATION OF CUSHIONING MATERIALS, by George E. Murray. Apr 58, 19p. 6 refs. Technical rept. CP-12.
Order from LC mi$2.40, ph$3.30 PB 135 114

The relations of energy and motion to the cushioning properties of energy dissipators are described. This preliminary analysis shows that fragility factors should be expressed in stress units rather than in gravities. In this respect, the importance of the stress-strain curve and the resilience of energy dissipators are discussed.

Radio Corp. of America, Camden, N. J.
PRELIMINARY INVESTIGATION OF HYPER ENVIRONMENTS AND METHODS OF SIMULATION. PART I. NATURAL AND INDUCED ENVIRONMENTS ABOVE 75,000 FEET, by R. A. Di Taranto and J. J. Lamb. Final rept. on Part I of Contract AF 33(616)3915. July 57, 86p. 86 refs. WADC Technical rept. 57-456, pt. 1; AD-142 002.
Order from LC mi$4.80, ph$13.80 PB 138 227

This report covers the survey portion and contains the conclusions as to the natural and induced environments which will be encountered by future USAF weapon-systems and the extent to which these environments are considered detrimental to the operational characteristics of subsystems and equipments used in USAF weapon systems. Nuclear Environments are not considered since they would present a complete study program in themselves. Where known, the possible deleterious effects of each environment are listed, and the environments which must be considered for testing or simulation, with their variations, are given. The possible induced environments are dependent upon the configuration of the vehicle, use of the vehicle, altitude of operation, flight speed, power plant, and design of the airframe and interior. The induced environments considered were: (1) Temperature, (2) Acceleration, (3) Vibration, (4) Shock, and (5) Zero Gravity. In the same manner as is done for the natural environments, the possible deleterious effects of each induced environment are listed, and the environments which are considered for testing or simulation, with their variations, are given.

Research, Inc., Hopkins, Minn.
DESIGN MANUAL FOR WINDSHIELD JET AIR BLAST RAIN AND ICE REMOVAL, by Harry R. Meline and Ivan D. Smith. Rept. on Contracts AF

33(616)5145 and AF 33(616)5513. Nov 58, 486p. WADC Technical rept. 58-444; AD-208 282.
Order from OTS $6.00 PB 151 595

This manual contains the results and design criteria which evolved from an extensive systematic wind tunnel test program conducted for the purpose of experimentally investigating the mechanics of jet air blast rain and ice removal from aircraft windshields. Tests were conducted with a variety of typical full-scale windshield and jet air blast nozzle configurations at numerous tunnel free stream velocities and under accurately controlled rain conditions and a heavy icing condition typical of modern adverse weather flight. Combinations of jet air blast velocity, weight flow, and temperature were combined with the above variables. Design criteria are presented in the form of curves, sketches, and photographs to illustrate the relative and absolute effect of all variables on windshield visibility. Supplementary data include windshield surface temperatures, boundary layer profiles, heat transfer coefficients, etc. This manual will aid aircraft designers to design more nearly optimum jet air blast rain and ice removal systems for particular aircraft. Results indicate that a jet air blast system is a very effective method of providing improved vision under rain and icing conditions over a broad range of flight velocities. This system is particularly suitable to turbojet and turboprop aircraft where a supply of compressor bleed air is normally available.

Research, Inc., Hopkins, Minn.
INVESTIGATION OF METHODS OF ANTI-ICING GAS TURBINE INLET COMPONENTS, by J. E. O'Neil and J. A. Zdrazil. Rept. on Contract AF 33(616)2726. June 56, 161p. 19 refs. WADC Technical rept. 56-292; AD-118 661.
Order from LC mi$7.80, ph$25.80 PB 137 768

A study of the methods of application of anti-icing principles to gas turbine power plant air induction system components was conducted under this program. Model shapes representative of full scale components were designed, fabricated, and equipped with anti-icing protection systems. The models were subjected to controlled artificial icing conditions and data obtained on the degree of protection afforded. The testing phase of the program was conducted by Research, Incorporated, personnel at the Research, Incorporated, Hopkins, Minnesota, icing facility and at the Aeronautical Icing Research Laboratories, Mt. Washington, New Hampshire, during the latter part of the 1955-56 icing season. It was concluded that hot air heat exchangers, electrical resistance elements, and fluid freeze-point depressant anti-icing systems are effective, but that proper design techniques are necessary to achieve maximum efficiency.

Southern Research Inst. [Birmingham, Ala.]
MEASUREMENT OF THE THERMAL PROPERTIES OF VARIOUS AIRCRAFT STRUCTURAL MATERIALS, by John V. Melonas, Perry C. Covington, and Coultas D. Pears. Rept. for 1 Jan 57-1 Jan 58 on Rubber, Plastic, and Composite Materials, Contract AF 33(616)3328. Nov 58, 62p. WADC Technical rept. 58-179; AD-204 795.
Order from OTS $1.75 PB 151 546

Thermal expansion, specific heat, and thermal conductivity properties were measured for six structural panels and cores through a temperature range from -100° to 600° F. In addition, some physical tests were made on these materials. The materials covered in the investigation consisted of one asbestos-resin laminate, three fiberglass-resin laminates, and two fiberglass-resin fluted core sandwich panels. The test procedures and equipment used in the thermal property evaluations are modifications of the procedure described in WADC TR 54-306 according to MIL and Federal specifications.

Southern Research Inst., Birmingham, Ala.
TENSILE PROPERTIES OF AIRCRAFT-STRUCTURAL METALS AT VARIOUS RATES OF LOADING AFTER RAPID HEATING, by Haywood E. Dedman, Edmund J. Wheelahan, J. Robert Kattus. Rept. for May 57 - June 58, on Material Analysis and Evaluation Techniques, Contract AF 33(616)3996. Nov 58, 221p. WADC Technical rept. 58-440, Part 1; AD-206 074.
Order from OTS $3.50 PB 151 566

The purpose of this work was to evaluate the short-time tensile properties of aircraft-structural materials under conditions of rapid heating, short times at temperature, and moderate to rapid rates of loading. The test specimens were heated to the test temperatures within ten sec, held for periods of time ranging from 10 sec to 1800 sec, and loaded at strain rates from 0.00005 to 1.0 in./in./sec. Major emphasis was placed on the accurate determination of 0.2%-offset yield strength and ultimate tensile strength. The modulus of elasticity, percent elongation, proportional limit, and full stress-strain curves were determined with somewhat less accuracy but, nevertheless, with sufficient accuracy to establish trends. Four steels—Chro-Mow tool steel, Thermold-J tool steel, Peerless-56 tool steel, and AM-350 precipitation-hardening stainless steel—and 6A1-4V titanium alloy were fully evaluated, the steels being tested at temperatures up to 1200° F and the titanium alloy up to 1000° F. The test results show that, at the lower test temperatures, the strength properties of the test alloys tended to increase slightly or to remain constant with increasing strain rates. Near the maximum test temperatures, the effect of strain rate became much greater, the strength properties increasing greatly with increasing strain rates. Probably as a result of structural changes associated with tempering and with overaging the strength of the steel alloys decreased with increasing holding times at 1200° F. The tensile properties of the steel alloys at lower temperature and of the titanium alloy at all test temperatures were not affected by variations in holding time.

Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF AIR FORCE ENVIRONMENTAL CRITERIA SLIDE RULE, by R. E. Engelhardt. Final rept. on Contract AF 33(616)3872. July 57. 53p. WADC Technical rept. 57-286; AD-118 296.
Order from LC mi$3.60, ph$9.30 PB 137 023

A study was made to develop some method by which a designer or engineer could be quickly acquainted with the basic environmental criteria which are applicable to any particular item of Air Force equipment. The

initial step in this process was the formulation of a categorization system in which all similar materiel was placed in groups. The basic division of the materiel consisted of ground support, aircraft, and guided missile sections because the environmental criteria appeared to be also divided in this manner. The creation of subgroups within these initial sections was based upon the location, function, or method of operation of the various items of equipment: Appendix A of the resulting 25 categories. Appendix B of this report presents a detailed listing of the percentages of specifications containing environmental criteria and for comparison purposes lists the recommended criteria as presented on the slide rule. The final phase of the program consisted of an integration of the first two phases and the presentation of this information in the form of a slide rule. The slide rule lists not only the materiel categories and the respective test procedures, but also information regarding general requirements, ram air temperature rise and estimated future requirements. Size limitations have restricted the quantity of detailed information placed on the slide rule, thereby making it mainly applicable to the general case rather than the specific; however, it is estimated that the presentation is accurate for at least 85 per cent of the equipment contained in each category.

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
PERFORMANCE TESTS OF FOUR FEDERAL AIRWAYS VOR FACILITIES, by S. R. Anderson, T. S. Wonnell, and A. E. Frederick. Apr 55, 29p. Technical Development rept. no. 273.
Order from LC mi$2.70, ph$4.80 PB 137 339

Technical Development Center, Civil Aeronautics Administration, Indianapolis, Ind.
SIMULATION TESTS OF A HORIZONTAL DISPLAY FOR THE CONTROL OF HIGH-ALTITUDE TRAFFIC, by Clair M. Anderson. Nov. 58, 11p. Technical development rept. no. 287.
Order from OTS $0.50 PB 151 474

Simulation tests were conducted to determine the practicability of using a horizontal plotting display instead of a flight progress board for the procedural control of high-altitude aircraft in an Air Route Traffic Control Center. Movable target markers carried the pertinent flight data for each aircraft on a horizontal plotting board which was scaled 8 miles to the inch. The use of projected course lines, plotted with grease pencil and calibrated in time, also was tried. Tests, based on recent actual traffic samples of the Indianapolis Air Route Traffic Control area for all aircraft flying at 24,000 feet mean sea level and above, indicated that the use of this display was practicable for handling present traffic loads. The use of projected course lines was found to be unnecessary except for aircraft with unusual flight paths.

Thieblot Aircraft Co., Inc., Washington, D. C.
THE FLYING PIPE REFUELING SYSTEM, by James Robert Kirby. Rept. for Apr 55-July 57 on Flying Pipe Refueling Package, Contract AF 33(600)30155. Oct 57, 59p. 7 refs. WADC Technical rept. 57-511; AD-142 090.
Order from LC mi$3.60, ph$9.30 PB 137 375

A high-speed, high altitude "buddy" aerial refueling system was designed, fabricated, and tested. The refueling system consists of a standard 450 gallon external fuel tank housing an extendable rigid linkage refueling mechanism which is mounted in a store location on the fighter aircraft. In this manner one fighter can be equipped as a tanker to refuel another fighter. The system was designed for easy installation on any fighter type aircraft. The tests indicate that the system can be used successfully and safely.

University of Southern California. Engineering Center [Los Angeles]
A STUDY OF ANGLE-OF-ATTACK ANGLE-OF-SIDESLIP PITOT-STATIC PROBES, by Frederick O. Smetana and Jay Wm. Stuart, Jr. Rept. on Contract AF 33(616)3715. Jan 58, 127p. 29 refs. WADC Technical rept. 57-234; AD-118 209.
Order from LC mi$6.30, ph$19.80 PB 136 481

Measurement of angle of attack and angle of sideslip without recourse to devices which have moving parts external to the aircraft was found to be in a more elementary state of development. The result of the literature survey indicated that the most suitable method fitting these requirements was either a fixed-type, pressure-sensing system or a device operating on a previously unused principle. Such a system was found and its theoretical formulation is given.

Civil Engineering

Army Engineer Waterways Experiment Station, Vicksburg, Miss.
PROTOTYPE SPILLWAY CREST PRESSURES, CHIEF JOSEPH DAM, COLUMBIA RIVER, WASHINGTON, by Benson Guyton, J. V. Dawsey, Jr., and H. A. Bell, Jr. Apr 58, 41p. Miscellaneous paper no. 2-266.
Order from LC mi$3.30, ph$7.80 PB 136 141

Massachusetts Inst. of Tech., Cambridge.
INTERNAL STRESS GAUGES FOR CEMENTITIOUS MATERIALS, by Y. C. Loh. Rept. on Contract N5ori-078(47). July 51, 146p. 13 refs. ATI-123 809.
Order from LC mi$7.20, ph$22.80 PB 139 048

Design requirements of internal gauges, the different electric, acoustic and optical gauging systems which are applicable to internal measurements, and the construction and test results of an internal stress gauge are discussed. The basic principles of different types of gauging systems are described. An internal stress gauge for use in concrete is 1/2 in. diameter and 1 1/4 in. long and made of chromemolybdenum steel. The equivalent modulus of elasticity of the gauge is 5×10^6 lbs/sq in and the working range is from 1000 lbs/sq in in tension to 9000 lbs/sq in in compression. The accuracy of the gauge is about 50 lbs/sq in. The

gauge is designed to be used for both static and dynamic measurements. Tests of embedded stress gauges under compressive load, tensile load, lateral load, sustained load and dynamic load are presented.

Electrical and Electronic Engineering

[Aerial Reconnaissance Lab.] Wright Air Development Center, Wright-Patterson AFB, Ohio.
CHARACTERISTICS OF RADAR ALTIMETERS, by Albert Goldman. Apr 53, 12p. WADC Technical rept 53-120; AD-14 764.
Order from LC mi$2.40, ph$3.30 PB 136 407

The basic differences between radar altimeters and barometric altimeters are described. Characteristics of radar altimeters, standard types and those in the final phases of development, are described and tabulated. The usual applications of radar altimeters are listed and a check list is furnished to air prospective users in describing their special requirements.

Aero Medical Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
DEVELOPMENT OF CONDUCTIVE CLOTH PLANTAR ELECTRODE FOR USE IN MEASURING SKIN RESISTANCE, by Nina K. Morrison. Rept. on Biophysics of Space Flight. Oct 58, 15p. 5 refs. WADC Technical Note 58-284; AD-204 425.
Order from OTS $0.50 PB 151 560

This report describes the design and development of a conductive cloth plantar electrode for use in studies of galvanic skin resistance changes. The conductive cloth electrode proved to be more effective than lead electrodes due to its flexibility, comfort over extended time periods, light weight, and better continuous contact with the foot. The concept of placing the electrodes inside socks is presented as it was developed for skin resistance studies of subjects who were active over extended periods of time. These sock electrodes were worn continuously for periods up to seven days without discomfort, and the GSR writeout was relatively free of movement artifacts.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
EFFECTS OF BRIGHT POINT LIGHT SOURCES ON LOW LEVEL IMAGE ORTHICON DETECTORS, by Radames K. H. Gebel. Apr 58, 9p. WADC Technical Note 58-116; AD-155 503.
Order from OTS $0.50 PB 151 587

For military applications, the image orthicon type tube faces a rather serious target detection problem and limitation, when viewing low light-level target scenes, due to high brightness point light sources that may appear in these scenes. The high brightness point source effect, and the causes thereof, are discussed in detail. Electronic means for compensating for this effect are discussed; appropriate changes in the internal components and geometry of the tube are suggested.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
AN IMAGE ORTHICON WITH A NARROW RANGE OF ELECTRON ENERGY IN THE SCANNING BEAM. by Radames K. H. Gebel. Apr 58, 13p. WADC Technical Note 58-118; AD-155 505.
Order from OTS $0.50 PB 151 589

A method of improving the low light level performance of image orthicon devices, by making certain basic design changes in tube geometry, is outlined and discussed. The electron-optical relationships for the scanning beam are developed. In the development, it is shown that, for a scanning beam of narrow electron energy range, the beam modulation factor can be made very low, thereby improving the performance of the tube. It is also shown how a very accurate control over both the energy range and the direction of the electrons in the scanning beam can improve both focus and resolution of the scanned picture.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
A MILITARY COLOR TELEVISION SYSTEM USABLE WITH OPTICAL APPLICATION, by Radames K. H. Gebel. Apr 58, 12p. WADC Technical Note 58-114; AD-151 198.
Order from OTS $0.50 PB 151 586

The need for a good practical military color television system is emphasized and discussed. The technical possibilities and limitations of color television systems, in general, are discussed. The more important types of color systems are outlined, with emphasis on motion-detection limitation. A superior color television system for general military application is outlined, which is suitable for use with or without optical amplification.

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
MICROPHONIC EFFECTS IN IMAGE ORTHICONS, by Radames K. H. Gebel. Apr 58, 14p. WADC Technical Note 58-117; AD-155 504.
Order from OTS $0.50 PB 151 588

Image orthicon tubes are often subject to microphonic effects in their outputs due to physical vibration or oscillation of internal tube components such as the target screen, target plate, etc. Both experimental and theoretical investigations have been conducted on these tubes in order to determine the cause and best solution to the microphonic problem. While the investigations have shown that it is possible to elimate microphonics in these tubes electronically, the best solution to the microphonic problem can be obtained by careful design and construction of vibration-proof internal tube components.

Air Force Cambridge Research Center, Bedford, Mass.
NEW SINGLE ANTENNA INTERFEROMETER SYSTEM USING PROXIMITY-COUPLED RADIATORS, by Carlyle J. Sletten, F. Sheppard Holt and others. Mar 58, 47p. 5 refs. AFCRC TR 58-115; AD-152 364.
Order from LC mi$3.30, ph$7.80 PB 135 216

A new dual terminal antenna composed of 22 proximity-coupled radiating elements is described. This paper discusses the analytic behavior of dual-terminal arrays and presents experimental results with the sun, moon, and Explorer I as sources. A new stable integrating receiver is presented in detail. This "single antenna interferometer" and radio astronomy receiver gives a single angle bearing to high accuracy on very weak signals without ambiguity. Excellent meridian crossing data on Explorer I is reported using this novel antenna-receiver equipment. This installation, located near Bedford, Mass., enabled scientists to establish this satellite's period to a small fraction of a second.

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
PROCEEDINGS [OF THE] ELEVENTH ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE, 22-23 May 1957. 122p. 62 refs.
Order from LC mi$6.30, ph$9.80 PB 137 392

Research Symposium: Solid electrolyte batteries; Ion-exchange batteries; Organic depolarizers; Boron trifluoride batteries; Ammonia vapor activated batteries; Non-aqueous solvent electrochemical systems. Primary Battery Symposium: Low Temperature Batteries: New approaches to improvements in low temperature dry batteries; Application of heating principles to Leclanche batteries; Application of heating principles to alkaline dry batteries. Improvement of Storageability: Investigation of shelf life of dry batteries; Improvement in storageability of dry cells; Management of dry batteries in military channels. New Dry Battery Structures: Trends in miniaturization of communication batteries; Wafer type Leclanche cells; Improved Leclanche flat cells; Battery pack vs. low voltage transistor converter. Dry Battery Materials: New battery separator materials; Effect of atmospheric storage on MnO_2; Report of battery-grade MnO_2 committee. Secondary and Special Purpose Battery Symposium: A program for determining reliability of missile batteries; Development and reliability investigations of zinc-silver oxide missile batteries; Separator material for special purpose batteries; Characteristics of zinc-silver oxide molten electrolyte cell systems; Chlorine depolarized batteries; Water-activated batteries; Secondary batteries; Calcium-lead grid batteries; Cadmium-silver oxide batteries; Conductive plastics for batteries. Nickel-Cadmium Batteries: Vented Ni-Cd batteries; Sealed sintered plate Ni-Cd batteries; Sealed cells with solar converters. Symposium on New Energy Sources: Solar Energy Devices: Solar enery and energy storage devices; New solar converter materials; Application of solar energy. Nuclear Batteries: The Elgin-Kidde nuclear battery; Constant current charging type nuclear batteries; Thermoelectric type nuclear batteries.

Atomic Energy Research Establishment (Gt. Brit.)
INTEGRATION OF CURRENTS FLOWING THROUGH AN ELECTROLYTIC CELL, by E. H. Cooke-Yarborough. 4 Mar 52, declassified Apr 58. 9p.
Order from BIS $0.37 AERE EL/M 70

Methods of integrating the current flowing through an electrolytic cell are considered and it is shown that serious errors may be introduced if the current falls off rapidly with time. Methods of minimizing these errors are considered and it is concluded that, if suitable precautions are taken, an accuracy better than 1% should be obtainable.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE APPLICATION OF POLYNOMIAL EXPANSIONS IN THE ANALYSIS OF NONLINEAR CIRCUITS, by Keats A. Pullen. Oct 58, 59p. 9 refs. Rept. no. 1057.
Order from LC mi$3.60, ph$9.30 PB 138 129

A brief review of the standard techniques of calculating the properties of nonlinear circuits, averaged signal, small signal, and Fourier series, is followed by a few notes on the use of the Vandermonde determinant with nonlinear cirucits. The balance of the report is devoted to the use of orthogonal ("O") or Legendre ("L") polynomial techniques for the solution of simple nonlinear circuits and also circuits which have load contours representable by two branches. As examples, a push-pull amplifier, having both resistive and reactive components in its load circuit, and a hysteresis loop are analyzed by the use of orthogonal polynomials.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. TASK XX: ELECTRICAL-INDICATING-INSTRUMENT RECTIFIERS, by L. H. Stember, Jr. and P. G. Perry. Final rept. on Contract DA 36-039-sc-63136. Sep 55, 71p. AD-115 180.
Order from LC mi$4.50, ph$12.30 PB 136 293

Five hundred and six full-wave bridge rectifier assemblies (manufactured as such or as diodes connected to form full-wave bridge units), procured from nine manufacturers, were included in the investigations for this task assignment. The semiconducting elements represented were silicon, germanium, selenium, and copper oxide. Investigations were conducted to determine the effects of temperature, frequency, thermal cycling, moisture-resistance cycling, and shelf-life storage. Initial records also were made of continuous d-c current-voltage characteristics and of the rectifier's insulation qualities.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING: TASK XXV. HIGH- AND LOW- AND VOLTAGE-SENSITIVE ELEMENTS, by E. G. Lebre, Jr. and P. G. Perry. Final rept. on Contract DA 36-039-sc-63136. 30 Sep 55, 82p. AD-96 365.
Order from LC mi$4.80, ph$13.80 PB 136 294

Research was conducted to determine the effects of HF and LF vibration, mechanical shock, and constant-acceleration forces on the physical and electrical properties of fixed and variable resistors, thermistors, and voltage-sensitive elements. Each investigation included 5 specimens from each category, make and rating; the effects of the applied forces were evaluated in terms of the changes occurring in the specimens' mechanical and electrical properties. Forces of LF vibration, mechanical shock, and constant acceleration caused no physical failures and produced

only minor changes in the mechanical and electrical properties of all the specimens. HF-vibration forces caused mechanical failures in 4 of the 6 specimen categories. The most detrimental frequency in the range from 55 to 2000 c was that at which the specimen resonated with the maximum amplitude of motion; the condition usually occurred at the lowest resonant frequency. For the variable resistors, transient electrical-resistance changes were observed during mechanical resonance.

Battelle Memorial Inst., Columbus, Ohio.
COMPONENT EVALUATION AND SPECIFICATION ENGINEERING. TASK XXX: ADJUSTABLE WIRE-WOUND POWER RESISTORS, by W. E. Chapin. Final rept. on Contract DA 36-039-sc-63136. 1 Oct 56, 37p.
Order from LC mi$3.00, ph$6.30 PB 138 553

Bell Telephone Labs., Inc., New York.
MINIATURE POWER TRANSFORMERS HAVING WIDE TEMPERATURE RANGE, by L. W. Kirkwood. Rept. for 1 July 55-30 Mar 57 on Improved Electronic Components, Contract AF 33(600)24120. Sep 57, 153p. WADC Technical rept. 57-223; AD-130 986.
Order from LC mi$7.50, ph$24.30 PB 136 722

This report covers investigations of certain capabilities and limitations of miniature power transformers designed for 1000 hours minimum life at 200°C ambient temperature. This contract extension explores the extreme potentialities of these transformers, the maximum life expectancy at 200°C ambient temperature, the maximum ambient temperature that could be employed without sacrifice of a 1000-hour life, and the capability of operating at altitudes up to 70,000 feet instead of 10,000 feet.

Bureau of Ships, Washington, D. C.
RELIABILITY OF ELECTRONIC EQUIPMENT, by H. N. Wallin. 15 June 53, 7p. NAVSHIPS-91957.
Order from LC mi$1.80, ph$1.80 PB 137 646

Chatham Electronics Div., Gera Corp., Livingston, N. J
INVESTIGATION OF PRESSURE CHARACTERISTICS OF TUBE TYPE JAN 5948/1754, by George S. Kekely. Final rept. for 31 Aug 55-30 Aug 57 on Contract DA 36-039-sc-70134. 28 Oct 54, 97p.
Order from LC mi$5.40, ph$15.30 PB 138 087

It is shown in this report that all operating voltages may be applied simultaneously to a JAN 5948/1754 hydrogen thyratron with no apparent deleterious effects. It was also determined that the tube would fire in less than three minutes if a fast heating reservoir were available. Additional information indicates that the cathode does not completely stabilize in regard to specific tad limits in less than five minutes from a cold start. In view of the initial findings during the investigation, the scope of the contract was enlarged to cover the design and development of a fast starting reservoir.

Columbia U. School of Engineering, New York.
TOPOLOGY AND THE SOLUTION OF LINEAR SYSTEMS, by Robert B. Ash. Technical rept. T-31/B on Contract AF 18(600)677. 15 June 58, 20p. 6 refs. CU-48-58-AF-677-EE; AFOSR TN-58-726; AD-162 261.
Order from LC mi$2.40, ph$3.30 PB 136 870

The concepts of linear graph theory are applied to the study of feedback systems. Two topological matrices, called the exit and entrance matrices, are defined and the transmission matrix of the system is expressed in terms of these matrices. The properties of these matrices are examined, and a relation between nonsingular submatrices and nontouching feedback loops is established. Graph theory and the theory of determinants allow a rigorous derivation of Mason's general gain formula. A systematic method, based on the topological formulas derived in the paper, of finding all forward paths and feedback loops without drawing the graph of the feedback system is demonstrated.

Cruft Lab., Harvard U., Cambridge, Mass.
SECONDARY EMISSION PULSE CIRCUIT, ITS ANALYSIS AND APPLICATION, by Jan A. Narud. Rept. on Contract Nonr-1866(16). 5 Apr 57, 43p. 11 refs. Technical rept. no. 245; AD-131 984.
Order from LC mi$3.30, ph$7.80 PB 136 042

A regenerative pulse circuit is described which uses a single EPF 60 thermionic secondary emission tube (made by Phillips in Holland) that can generate pulses with a 6-mμsec rise time and a continuously variable width from 25 mμsec to 12μsec. A circuit analysis wherein expressions are derived for pulse width and resolving time is followed by various practical circuit realizations which include a millimicrosecond pulse generator and a fast pulse-height discriminator. The analysis showed that the ratio between the saturation current and the product of total capacitance (C) times the grid-voltage interval between saturation and cutoff represents a figure of merit for how well a vacuum tube will perform in a switching circuit. The analysis suggested that the loop gain equals unity at the points from which jumps take place.

Dalmo Victor Co., Belmont, Calif.
INSTRUMENTATION FOR THE DETERMINATION OF PHASE DELAY IN A RADOME WALL, by Bernard Carpe. Rept. on Radome Techniques and Components, Contract AF 33(616)3092. Oct 58, 31p. 9 refs. WADC Technical rept. 57-722; AD-202 552.
Order from OTS $1.00 PB 151 549

The purpose of the report is to describe the development of an instrument suitable for accurate measurements of relative changes in electrical thickness. The theory of operation as developed shows that the electrical thickness and effective dielectric constant are functions of the reflected phase and amplitude of a radome. During the course of the development work certain inherent sources of error, effect of loss tangent, and horn requirements have been established. The automation of the device and the prescribed calibration and measurement procedure permit use of the instrument as specified, while the technique developed and information gained provide the basis for the use of the reflection measurements for quality control of production radomes.

Dielectrics Lab., Johns Hopkins U., Baltimore, Md.
DIELECTRIC MATERIALS MOISTURE RESISTANCE STUDY, by John J. Chapman and Louis J. Frisco. Final rept. for 26 Feb 53-31 Mar 55 on Contract NObsr-63251. Mar 55, 72p.
Order from OTS $2.00 PB 151 014

Includes Solid Dielectric Breakdown Techniques, reprint from Jnl. of the Electrochemical Society 102:67-72; Feb 1955.

Materials investigated included: polyethylene, polystyrene, monochlorotrifluoroethylene, polytetrafluoroethylene, polytetrafluoroethylene-glass laminate, glass silicone laminate, glass bonded mica, mica-filled phenolic resin (molded), mineral filled diallyl phthalate resin (molded) cellulose-filled melamine resin (molded).

Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
RESEARCH STUDY ON HYDROGEN THYRATRONS, by Stuart T. Martin and Seymour Goldberg. Final rept. for June 51 to June 53 on Basic Investigation of Hydrogen Thyratrons, Contract DA 36-039-sc-15372. 313p. 19 refs. AD-27 854.
Order from LC mi$11.10, ph$48.60 PB 137 519

Careful measurements of the time dependence of current and voltage have been made of typical 4C35 hydrogen thyratrons during (a) Breakdown of the grid space (b) Commutation of the discharge to the anode (c) Fall of anode potential (d) Conduction of positive ions to the anode following the zero of load current (e) Decay of plasma (deionization) (f) Recovery of the ability to withstand anode voltage. In addition the characteristics of the equilibrium discharge were also measured.

Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
RESEARCH STUDY ON HYDROGEN THYRATRONS, by Seymour Goldberg. Final rept. II for July 53-Oct 55 on Contract DA 36-039-sc-52589. [1955] 330p. AD-90 065.
Order from LC mi$11.10, ph$50.10 PB 138 673

Study of the factors influencing the operation and life of hydrogen thyratrons has included the theoretical considerations involved in the triggering, anode breakdown, conduction and recovery intervals in the tubes. The work has shown that anode breakdown proceeds from the breakdown of the grid-cathode space by the applied trigger, which leads to the growth of a plasma near the grid apertures. Electrons from this plasma cause a series of cumulative events in the anode space that lead to breakdown.

Edgerton, Germeshausen and Grier, Inc., Boston, Mass.
RESEARCH STUDY ON HYDROGEN THYRATRONS, by Seymour Goldberg and Daniel F. Riley. Final rept. III, Oct 55-Jan 57 on Contract DA 36-039-sc-70131. [1957] 125p. AD-132 703.
Order from LC mi$6.30, ph$19.80 PB 138 672

The development, construction and testing of ceramic-metal envelope hydrogen thyratrons has culminated in the procurement of a set of design criteria for hydrogen thyratrons. The design approach to the general tube geometry and the anode, grid and cathode structures is presented, together with the factors that have influenced this approach. Reservoir design information is also included. The design of an improved hydrogen thyratron utilizing the design criteria set forth and test information which justifies the design criteria are presented. Continued effort has been devoted to ascertain the causes of gas cleanup.

Electronic Defense Lab., Inc., Mountain View, Calif.
DEVELOPMENT OF C-BAND KLYSTRON, by William H. Thon. Rept. for 1 May 56-6 Aug 57 on Electronic Tubes and Transistors, Contract AF 33(616)3627. Sep 58, 90p. 4 refs. WADC Technical rept. 57-697; AD-155 864.
Order from OTS $2.25 PB 151 332

A series of experimental C-band klystron oscillator tubes, resonator test apparatus, and an electron-gun tester were designed, manufactured, and tested. Fourteen tube models were designed according to floating-drift-tube-klystron theory, and nine tubes were completed to the point of producing useful r-f output power. The characteristics and electrical performance of all tubes manufactured during the development program are reported in detail, and cross-sectional drawings of the various models are included. A new and original principle of klystron operation was devised and employed in one experimental model known as the reflex floating-drift-tube klystron. The theory and experimental results are described herein. The resonator test apparatus provided a means of investigating the resonant frequency of the floating-drift-tube resonator and a number of other important characteristics, including the figure of merit. The gun tester provided accurate information regarding the beams produced by convergent-flow electron guns. Several of the tubes developed during the reported program fulfilled a portion of the objective performance specifications, and the work described by this report indicates that further development of the floating-drift-tube klystron will result in a tube that will fulfill all objective specifications with the exception of efficiency.

Electronics Research Labs., Columbia U., New York.
ON LEAST SQUARE MULTIPLE INPUT FILTERING, by Moshe Zakai. Technical rept. T-9/133 on Contract AF 19(604)1572. 18 Aug 58, 51p. 19 refs. CU-15-58-AF-1572-EE; AFCRC TN-58-381; AD-160 832.
Order from LC mi$3.60, ph$9.30 PB 136 575

The purpose of the work described in this report was to investigate the possibility of obtaining an explicit solution in terms of matrix valued functions. This was accomplished for the case of "infinite lag filters." In principal, this is also possible for the case of physically realizable filters. Such a solution involves a matrix factorization (analogous to the problem of the factorization of the input spectral density function in the single input case). We have found an algorithm for such a factorization only for a few cases of 2 x 2 matrices.

Electronics Research Lab., U. of California, Berkeley.
SINUATE ANTENNA, by H. K. Macomber. Rept. on Contract N7onr-295(29). 30 Sep 57, 37p. 9 refs. Rept. no. 73; Series no. 60, Issue no. 195.
Order from LC mi$3.00, ph$6.30 PB 136 273

The purpose of the work described here was to conduct a theoretical and experimental investigation of the far zone radiation patterns of a planar, sinuate, filamentary antenna mounted parallel to and one-quarter wavelength (free space wavelength measured at a frequency of 9.0 kmc.) away from a ground plane. Theoretical computations were made of the far zone radiation vector components of the two basic elements of the antenna, a one-half wavelength dipole and a semicircular bend of two wavelength circumference. The calculations were based on the assumptions of an unattenuated standing wave current distribution and a phase velocity along the filament equal to the velocity of light.

Empire Devices, Inc., Bayside, N. Y.
IMPULSE NOISE GENERATOR. Final development rept. Apr 54-June 56 on Contract AF 30(602)987. RADC TR-57-11; AD-114 233.
Order from LC mi$3.00, ph$6.30 PB 136 232

The development of an Impulse Noise Generator, capable of being used as a standard for noise figure measurements of system, more specifically radar receivers, is discussed. The complete system is outlined in block diagram form. The component parts are considered in detail and evaluated, and finally, results are presented and recommendations made.

Federal Telecommunication Labs., Nutley, N. J.
DEVELOPMENT OF X-BAND TRAVELING-WAVE TUBES, by J. N. Lenker, J. L. Peck, and F. Astorino. Rept. for 21 Apr 52-15 Jan 57 on Electronic Tubes and Transistors, Contract AF 33(600)8375. Jan 58, 156p. 7 refs. WADC Technical rept. 57-335; AD-151 069.
Order from LC mi$7.50, ph$24.30 PB 136 473

This is the final report under Contract AF 33(600)-8375 and summarizes the program of research, study, and development of broadband traveling-wave amplifier tubes in the frequency range from 7500 to 11,300 mc. The basic objective of this contract has been the extension of the frequency range and the increase of the power output which may be obtained from tubes in this band. The report summarizes the various steps through which the development has progressed in arriving at final production type designs for four different X-band traveling-wave tubes.

Florida U. Engineering and Industrial Experiment Station, Gainesville.
INDUCTION HEATING METHODS OF AIRCRAFT STRUCTURES TESTING. PART A. IMPEDANCE CHARACTERISTICS OF FLAT-TYPE WORK COILS, by Bruce E. Mathews. PART B. RADIATION FIELD-STRENGTH SURVEY, by Roger W. Sampson. Technical rept. no. 1 on Contract AF 33(616)3293; Continuation of Contract AF 18(600)682. 30 Apr 57, 59p. AD-130 319.
Order from LC mi$3.60, ph$9.30 PB 137 098

Impedance of the flat-type workcoil circuit used in the simulation of the aerodynamic heating of aircraft structures by induction heating. The range of impedance which may be encountered for practical test conditions, practical limitations on the maximum and minimum impedance which may be used in any particular test, and variations of the impedance during test caused by increased resistivity due to heating of the work and work coil. Design factors and generator characteristics and their effect on the coil-circuit impedance. Procedures followed in the radiation field strength survey at about 300 kc. The fact that it is not desirable to attempt to operate two r-f generators feeding adjacent work coils at exactly the same frequency is an important consequence of the survey. Conclusions are drawn from the survey and recommendations are made relative to planning for minimizing radiation signals.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDY OF THE EFFECTS OF PROCESSING TECHNIQUES AND MATERIALS ON AGING OF QUARTZ CRYSTAL UNITS, by Richard B. Belser and Walter H. Hicklin. Quarterly rept. no. 2, 15 Aug-15 Nov 55, on Contract DA 36-039-sc-64613; Continuation of Contract DA 36-039-sc-56753. 201p. AD-89 425.
Order from LC mi$9.30, ph$31.80 PB 137 381

Eighty-eight additional 10- to 17-mc AT-cut resonators, making a total of 120, have been mounted in HC-6/U metal cans during the current quarter. These units, which were stored in a constant-temperature oven at 75° C until 11 October and at 85° C thereafter, were measured for frequency daily during their first 15-day period of operation; afterwards they were measured at 5- to 7-day intervals. Frequency-time plots for these units are included, and an analysis of their aging behavior is presented. Units coated with sputtered rhodium, plus evaporated gold for frequency adjustment, showed distinct frequency drifts ascribable to the solid state diffusion of the bimetal layer. In tests of 30 variously coated units, mounted in glass-lined HC-6/U cans instead of electrocleaned ones, no definite trend of improvement could be noted. A new leak-detecting technique is described. A comparison of the behavior of the fabricated resonators by a modified 5-day aging test gave only 65% agreement.

Houghton Labs., Inc., Olean, N. Y.
PROTECTIVE INSULATING COATINGS FOR PRINTED CIRCUITRY AND/OR PRINTED CIRCUIT ASSEMBLIES, by Mark V. Goodyear and Alphonse Melfi. Quarterly progress rept. nos. 1-2, 1 Mar-31 Aug 57, on Contract DA 36-039-sc-73190. 2 nos.
Order from LC

Quarterly progress rept. no. 1, 1 Mar-31 May 57, 44p. mi$3.30, ph$7.80, PB 135 756
Quarterly progress rept. no. 2, 1 June-31 Aug 57, 36p. mi$3.00, ph$6.30, PB 135 755

Houghton Labs., Inc., Olean, N. Y.
PROTECTIVE INSULATING COATINGS FOR PRINTED CIRCUITRY AND/OR PRINTED CIRCUIT ASSEMBLIES, by Mark V. Goodyear and Alphonse Melfi. Final rept. for 1 Dec 57-28 Feb 58 on Contract DA 36-039-sc-73190. [1958] 46p.
Order from LC mi$3.30, ph$7.80 PB 136 059

Houghton Labs., Inc., Olean, N. Y.
RESEARCH STUDY FOR IMPROVEMENT OF INSULATING COATINGS FOR PRINTED CIRCUITRY, by Mark V. Goodyear and Donald W. Rice. Final rept. for 1 Feb 55-31 Jan 57 on Contract DA 36-039-sc-64608. [1957]. 37p. AD-113 295.
Order from LC mi$3.00, ph$6.30 PB 139 052

To develop a protective coating which will provide adequate protection for printed circuits over long storage periods and prevent any electrical deterioration during and following high humidity conditions.

Hughes Aircraft Co. [Culver City, Calif.]
SILICON TRANSISTOR, by S. Barnes, M. Becker and others. Final rept. for 1 Sep-30 Oct 53 on Contract DA 36-039-sc-42574. 172p. 40 refs. Rept. no. SC-14A-F; AD-49 970.
Order from LC mi$8.10, ph$21.30 PB 137 354

Objectives attained within the work scope of the contract have made possible the solving of many of the technical problems involved in the development of silicon semiconductor devices, and have confirmed the assumption that these devices can be produced eventually in production quantities at a consistently high quality level. A summary of work carried on in the areas of theory, research, and development is presented.

Linfield Research Inst., McMinnville, Oreg.
RESEARCH ON FIELD EMISSION CATHODES, by E. E. Martin and H. W. Pitman. Rept. for 12 Sep 56-11 Sep 57 on Electronic Component Sciences Research, Contract AF 33(616)3851; Continuation of Linfield Coll. Contracts AF 33(616)304 and AF 33(616)3247. Oct 58, 69p. 18 refs. WADC Technical rept. 58-234; AD-202 556.
Order from OTS $1.75 PB 151 552

Improved stability of operation of the field emission cathode is essential before this electron source can be effectively utilized in practical devices. Methods are described for greatly improving stability by avoiding changes in surface electric field and work function. Experimental testing of fixed voltage operation of a cold tungsten emitter has been extended beyond 3000 hours; in other cases current drift rates less than 5 per cent per 100 hours of operation have been observed over several hundred hours at currents of the order of 10^{-4} amperes. Comparable improvement during repetitive, microsecond, pulsed operation at pulse currents up to 0.1 ampere has been demonstrated. Techniques have included careful vacuum practice, envelope material nearly impervious to atmospheric gases, and thoroughly degassed refractory metal anodes shaped to minimize impingement of secondary electrons on tube envelopes. A second field of study has been the electrochemical behavior of refractory metals applied to the fabrication of field emitters. Formation and dissolution of oxide layers are believed to have a major influence on surface smoothness and emitter geometry. Useful results of this study are an automatically controlled method of emitter shaping and a means of removing material uniformly from small parts such as miniaturized cathode structures. The effect of variation of polishing cell parameters such as temperature, voltage and electrolyte concentration has also been investigated.

Magnavox Co., Fort Wayne, Ind.
INDUSTRIAL PREPAREDNESS STUDY OF ANODE GEL BATTERIES, by Judson West, Jr. and Ralph F. Koontz. Quarterly progress rept. no. 1, 1 July-1 Oct 54, on Contract DA 36-039-sc-46627. 48p.
Order from LC mi$3.30, ph$7.80 PB 136 013

The first quarter has been spent attempting to perfect a mechanical cell-to-cell bond and the following have been investigated: (1) welded anode-cathode can assemblies; (2) soldered anode-cathode can assemblies; and (3) soldered anode-cathode can assemblies where soldering occurred outside the stack by means of tabs attached to the anode and cathode can. A good physical weld between the anode and cathode can was accomplished. The dimples normally used on the anode can when pressure contacts are used were eliminated in order to stabilize the construction and obtain as much strength as possible in the weld. Incorporation of these assemblies into cell and battery constructions resulted in cells that gassed.

Magnavox Co., Fort Wayne, Ind.
INDUSTRIAL PREPAREDNESS STUDY OF ANODE GEL BATTERIES, by Judson West, Jr. and Ralph F. Koontz. Quarterly progress rept. no. 2, 1 Oct 54-1 Jan 55, on Contract DA 36-039-sc-46627. 45p.
Order from LC mi$3.30, ph$7.80 PB 136 017

During the second quarter we have attempted to establish positive cell-to-cell contact by mechanical means, such as, welding or soldering the cathode can to the anode can and by a conductive film applied to the anode and/or cathode can so that the film comes between the cells when in a series-arranged stack. We have attempted to accomplish a mechanical joint by soldering, using a soldering iron, a welder as a soldering iron and a carbon tipped Press-To-Heat tool. Batteries were assembled from parts using the soldering iron and the welder. We have also attempted to accomplish mechanical cell-to-cell contact by welding the anode can to the cathode can. In previous instances our assemblies incorporating this type contact gassed badly, this we attributed to electrode contamination of the anode and/or cathode can from the welding electrodes. We also attempted to establish a better cell-to-cell contact using a conductive coating between the anode and cathode can in a series arranged stack.

Magnavox Co., Fort Wayne, Ind.
INDUSTRIAL PREPAREDNESS STUDY OF ANODE GEL BATTERIES, by Judson West, Jr. and Ralph F. Koontz. Quarterly progress rept. no. 3, 1 Jan - 1 April 55, on Contract DA 36-039-sc-46627. 59p.
Order from LC mi$3.60, ph$9.30 PB 136 018

During the third quarter a large number of 17-cell batteries for low current drain applications were constructed. Two hundred sixteen (216) of these batteries have been sent to The Signal Corps Engineering Laboratory for their evaluation. In the laboratories these batteries show definite promise. To date, low drain batteries of similar construction have undergone 20 months storage at room temperature and at least 13 weeks storage at 45°C (113°F). Three batteries discharged through a resistance of 225,000 ohms after 13 weeks storage at 45°C (113°F) gave the following results: 1. One battery was allowed to run 90 hours before the test was discontinued. 2. One battery was allowed to run 138 hours before the test was discontinued. 3. The third battery ran 211 hours before reaching the cut-off voltage of 14.4 volts. The maximum time specified for batteries of this type after 3 months storage at 45°C is 60 hours.

Magnavox Co., Fort Wayne, Ind.
INDUSTRIAL PREPAREDNESS STUDY OF ANODE GEL BATTERIES, by Judson West, Jr. and Ralph F. Koontz. Quarterly progress rept. no. 4, 1 Apr-1 July 55, on Contract DA 36-039-sc-46627. 45p.
Order from LC mi$3.30, ph$7.80 PB 136 012

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
EFFECTS OF NOISE ON RANGE TRACKING SYSTEMS, by Jack Ruina. Rept. on Contract AF 28(099)8. 13 June 51, 26p. 13 refs. Rept. no. R-247-51; PIB-188; ATI-143 952.
Order from LC mi$2.70, ph$4.80 PB 137 043

A mathematical analysis has been made on a radar tracking system, with position memory, to determine the deterioration in the operation when noise is present in the system. Mathematical equations have been developed relating the probability of not losing the target in the presence of noise and the various parameters of the tracking unit. These equations were developed for two cases, viz: (1) When the signal is completely faded and the target is stationary. (2) When the signal is completely faded and the target is moving with some constant velocity.

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
FEEDBACK AMPLIFIER DESIGN BY FORWARD EQUIVALENT CIRCUITS, by L. M. Vallese. Rept. on Contract Nonr-839(05). 5 Sep 57, 47p. 8 refs. Research rept. R-605-57; PIB-533.
Order from LC mi$3.30, ph$7.80 PB 136 276

It is shown that by introduction of unilateral forward equivalent circuit representations the analysis of feedback amplifiers is greatly simplified. Typical shunt-, series-, and shunt-series-feedback circuits are investigated, with examples from vacuum tube narrow band amplifiers and transistor video amplifiers. Furthermore it is shown that by introduction of reciprocal forward equivalent circuit representations a direct synthesis procedure of active networks is made possible. This procedure is not restricted by frequency dependence of the active element or network configuration.

Minnesota U., Minneapolis.
A STUDY OF NOISE IN GAS DISCHARGES, by Aldert van der Ziel. Rept. on Electronic Tubes and Transistors, Contract AF 33(616)3337. Oct 58, 46p. 17 refs. WADC Technical Rept. 58-355; AD-204 094.
Order from OTS $1.25 PB 151 564

This study of noise in gas discharges is a continuation of the work reported in WADC Technical Report 57-409 (PB 135 051) of July 1957. One of the main results of that study was that a combination of impedance and noise measurements was needed for a better understanding of the mechanisms involved. This result was further substantiated by the present work. It has led to an understanding of the noise mechanism operating in ball-of-fire thyratrons; the observed noise can be represented by an equivalent circuit in which the elementary noise mechanism, caused by a random, independent series of damped oscillations, acts as a current generator in parallel with part of the equivalent circuit. A more detailed study has been made of the impedance of voltage regulator tubes and of gas discharge lamps; the results have been represented by equivalent circuits. In gas discharge lamps the impedance can often be represented by a distributed line network; the same equivalent circuit can also be modified to represent the impedance and noise behavior of internal and external probes. A study of the impedance and noise behavior of discharge lamps with variable anode-cathode distance has allowed us to observe the changes in these parameters accompanying the changes in gas discharge mode occurring with the change in anode-cathode distance.

Missouri U., Columbia.
ELECTROCHEMICAL SYSTEMS FOR USE IN LOW TEMPERATURE BATTERIES, by G. Myron Arcand. Final rept. for 1 June 56-15 July 57 on Contract DA 36-039-sc-72363. Aug 57, 32p. 4 refs.
Order from LC mi$3.00, ph$6.30 PB 135 749

Pyridine and acetonitrile have been studied as electrolyte solvents; acetonitrile was found to be the better of the two. A number of salts are quite soluble in acetonitrile. The alkali metal thiocyanates have the highest specific conductances of those investigated, especially when the system contains water. Addition of water not only increases the specific conductance but decreases the freezing point. A number of metal-metal oxide couples were studied. Zinc appears to be the best anode material, although magnesium may be satisfactory. Manganese dioxide-Shawinigan Black mixture is a satisfactory cathode material when certain basic salts are added.

Navy Electronics Lab., San Diego, Calif.
POWER SUPPLY STANDARDIZATION STUDY, by

R. H. Harwood and D. M. Lowe. Interim rept. 17 Feb 55, 48p. 130 refs. Rept. 547.
Order from LC mi$3.30, ph$7.80 PB 135 706

A study, consisting of a literature survey, on equipment survey, and analog computer simulation, was made of electronic power supplies to determine if simple, economical, and reliable standards could be established for electronic functional components. The study produced valuable information and appears to be a satisfactory type of study for use in establishing standard subassemblies. Recommendations for a standard line of power supplies and details of computer mechanization for power supply studies are presented.

Navy Electronics Lab., San Diego, Calif.
STATISTICAL ANALYSIS OF ELECTRONIC EQUIPMENT FAILURES AND EVALUATION, by R. J. Steelman. Evaluation rept. 21 Feb 55, 20p. Rept. 581; AD-109 047.
Order from LC mi$2.40, ph$3.30 PB 139 043

Forty-two published reports of the Evaluation Branch were examined, and the failures reported therein were statistically analyzed. The equipments covered a wide range of functions, and included radar sets, radio receivers and transmitters, sonar equipments, IFF coders, oscilloscopes, and power supplies. The relative frequency of occurrence of 28 common categories of failure was plotted as a bar graph. The largest category encountered consisted of instances of inadequate electronic design which were easily detectable with a minimum of instrumentation, and should have been corrected prior to submission of the equipment for evaluation. A second large category was poor design of operating controls, indicating a need for human engineering in the design of electronic equipment. It is recommended that Bureau of Ships contractors test their equipment more thoroughly before submitting it for evaluation.

Ohio State U. Research Foundation, Columbus.
ELECTRON PHYSICS AT MILLIMETER WAVELENGTHS, by E. M. Boone, W. H. Cornetet, Jr., and others. Rept. on Electronic Component Sciences Research, Contract AF 33(616)5073. Oct 58, 79p. 26 refs. WADC Technical rept. 58-282; AD-202 558.
Order from OTS $2.00 PB 151 553

The research work described involves the preliminary study of two electron tubes designed for millimeter-wave generation and the theoretical feasibility investigation of two other electron devices of somewhat novel character intended also for millimeter wave use. The drift-tube klystron frequency multiplier has been carried through the early design stages and is expected to provide a power output of the order of magnitude of 1 watt at a wavelength of 2 millimeters. No attempt has thus far been made to obtain any power at wavelengths shorter than 5 millimeters. The mixed-field reflex oscillator designed to operate at 3 centimeters has provided 270 milliwatts at a beam voltage of 500 volts. A redesign capable of scaling to millimeter wavelengths has been designed but is only in the early stages of experimental investigation. An axially symmetric magnetless carcinotron and a backward-wave oscillator with a new type of slow wave structure have been carried through the stage of theoretical analysis and component design. Interesting results on emission patterns of various cathodes obtained with the electron emission microscope have shown the superiority of cathodes prepared by powdered nickel techniques over all other cathodes tested.

Ohio State U. Research Foundation, Columbus.
STUDY OF SPACE-CHARGE-LIMITED POTENTIAL DISTRIBUTION IN ELLIPSOIDAL AND PARABOLOIDAL DIODES, by Ram Prakash Anand. Technical note 6 on Contract AF 18(600)980. June 58, 130p. 34 refs. AFOSR TN-58-570; AD-158 389.
Order from LC mi$6.30, ph$19.80 PB 136 163

Space-charge-limited potential distributions in certain new geometries were investigated with a view to developing better high-density electron beams. The problems studied include confocal and nonfocal ellipsoidal and paraboloidal geometries. A cathode and anode were chosen as confocal ellipsoids with axial ratios of 1.3 and 10, respectively. A gun with the following particulars was designed; cathode ellipsoid with an axial ratio of 1.3; anode-ellipsoid with an axial ratio of 10; and distance between major axes of cathode and anode is equal to half the semi-minor axis of the cathode. A preliminary investigation of confocal paraboloids revealed that current density is highest at the axis of symmetry and gradually decreases toward the edge. The electron paths between various non-confocal paraboloids were investigated.

Pickard and Burns, Inc., Needham, Mass.
IMPROVEMENT OF SIGNAL-TO-NOISE RATIOS OF THE COZI EQUIPMENT, by Walter Kostecki. Interim status rept. 1 July-Dec 57 on Contract AF 19(604)1502. 2 Jan 58, 11p. P & B Pub. no. 448; AFCRC TN-58-124; AD-146 834.
Order from LC mi$2.40, ph$3.30 PB 136 212

To improve the signal-to-noise ratio of the Cozi system by providing a coherent detector in place of a conventional detector in the receiver. The equipment must lock a 455-kc crystal oscillator in phase and frequency to the IF frequency of the Motorola R-390/URR receiver, to provide a reference frequency for the coherent detector. The return echo signals after conversion to 455 kc are detected and integrated in video phase detector circuitry.

Radio Corp. of America, Harrison, N. J.
DEVELOPMENT OF LOW NOISE, BROAD BAND TRAVELING WAVE TUBE, by Leslie D. Kovach. Rept. for 1 June 54-14 Jan 57 on Electronic Tubes and Transistors, Contract AF 33(600)27356. Apr 58, 55p. 16 refs. WADC Technical rept. 57-289; AD-155 507.
Order from LC mi$3.60, ph$9.30 PB 136 480

The basic design objectives and the related technical problems are outlined. Three tube design approaches, designated as Types A, B, and C, were studied to determine the best compromise in design toward meeting the objectives. Type A design favors flat gain and broad band characteristics more than low noise; Type C design emphasizes low noise characteristics; while

Type B is a compromise between those two designs. The design features and the measured performance characteristics of all three tube types are given.

Radio Corp. of America, Harrison, N. J.
DEVELOPMENT OF 100 WATT SHF-BAND TRAVELING WAVE TUBE, by Weislaw W. Siekanowicz and George Novak. Rept. on Electronic Component Operational Development, Contract AF 33(600)24400. Apr 58, 79p. 25 refs. WADC Technical rept. 57-600; AD-155 529.
Order from LC mi$4.50, ph$12.30 PB 137 201

This report describes the development of a 100 watt, S-band traveling wave amplifier operating over the 2000 mc. to 4000 mc. frequency band. The tube utilizes a lightweight periodic permanent magnet for electron beam focusing and is, therefore, suitable for airborne applications. The design of the helix, coaxial line-to-helix couplers, electron gun, attenuator, and periodic magnet is presented. The mechanical construction and processing of the tube is also described.

Raytheon Mfg. Co. Bedford, Mass.
IMPROVEMENT OF MAGNETOSTRICTION-ROD FILTERS. Interim technical rept. no. 1 on Contract AF 30(635)2902. Dec 56, 27p. BR-32.
Order from LC mi$2.70, ph$4.80 PB 135 358

The object of this report is to combine filters to obtain a desired output response. It will not be possible at all times, due to the limited number of degrees of freedom, to obtain a combination filter characteristic that is precisely the Butterworth characteristic or the Tchebycheff characteristic.

[Research Inst.] U. of Michigan, Ann Arbor.
EXPERIMENTAL FOLDED LOOP ANTENNA, by J. F. Cline and G. H. Robinson. Technical rept. no 69 on Contract DA 36-039-sc-63203. Nov 56, 26p. 3 refs. Rept. no. 2262-133-T; AD-120 102.
Order from LC mi$2.70, ph$4.80 PB 136 291

A study is being conducted to find a means for tuning the antenna by flexing or telescoping the loop in addition to varying the gap capacitance, in order to maintain a wide bandwidth as the center frequency is changed.

[Research Inst.] U. of Michigan, Ann Arbor.
SOME USEFUL TECHNIQUES FOR OVERCOMING THE FREQUENCY LIMITATIONS OF CONVENTIONAL DISTRIBUTED AMPLIFIERS, by P. H. Rogers. Technical memo. no. 32 on Contract DA 36-039-sc-63203. Nov 56, 27p. 3 refs. Rept. no. 2262-132-T; AD-120 059.
Order from LC mi$2.70, ph$4.80 PB 136 292

The prescription of the series inductance together with a practical coefficient of coupling limits the negative mutual inductance which can be reflected into the grid and plate leads. This paper shows that an optimum compromise in the interest of bandwidth exists between the ideas of a small series inductance and a substantial mutual inductance. An additional complication in the conventional circuit is that the minimum physical spacing between tubes determines a minimum practical series inductance for the lines.

Riverside Research Lab., Motorola, Inc., Calif.
EXPERIMENTAL INVESTIGATION OF MOUNTAIN OBSTACLE PATH TRANSMISSION, by H. R. Austin, R. E. Baker and others. Final rept. on Contract DA 36-039-sc-64556. Nov 55, 184p.
Order from LC mi$8.40, ph$28.80 PB 135 741

Numerous instances have been cited for which reliable radio communications circuits have been established over propagation paths highly obstructed by mountainous terrain and previously thought unusable. Suitable techniques have been evolved for utilizing this phenomenon to extend radio communication ranges in mountainous areas for non-line-of-sight paths. Experience indicates that a systematic procedure can be successfully followed in the selection of both usable paths and terminal sites to attain a 20 - 30 db reduction of path loss in mountainous areas.

Servomechanisms Lab., Mass. Inst. of Tech., Cambridge.
COMPARISON OF LEAD NETWORK, TACHOMETER, AND DAMPER STABILIZATION FOR INSTRUMENT SERVOS, by George A. Biernson. Rept. on Contract AF 33(616)2038. Dec 56, 23p. 4 refs. Technical memo. 7138-TM-10; Supersedes Engineering memo. 6506-EM-27; AD-127 513.
Order from LC mi$2.70, ph$4.80 PB 137 294

Three methods of phase compensation widely used to achieve stable operation in instrument servomechanisms are: lead networks, tachometer feedback, and viscous-coupled inertia dampers. This memorandum compares these types of compensation in such matters as servo bandwidth, velocity constant, torque constant, transient response, tolerance to gear train backlash, noise, and required amplifier gain. The purpose of this comparison is to provide a basis for selection of the most appropriate type of compensation for a particular problem.

Stanford Electronics Labs., Stanford U., Calif.
EXPERIMENTAL STUDY OF TAPPED DELAY-LINE FILTERS, by D. W. Lytle. Rept. on Contract AF 33(600)27784. 30 July 56, 84p. 13 refs. Technical rept. no. 361-3; AD-105 406.
Order from LC mi$4.80, ph$13.80 PB 138 269

A method of synthesizing a matched filter is developed through the use of the sampling theorem. This method makes use of tapped ideal delay lines together with lowpass filters and adding circuits to form both the matched filter and the matched signal generator. Theoretically this method permits the use of any finite bandwidth and finite time duration signal as the matched signal. The selection of matched signals is discussed in terms of the requirements on the matched-filter output and the desired properties of the matched signal itself. In order to simplify the problem of choosing a set of matched singals, the

signals are limited to those having sample values of plus and minus one.

Stanford Research Inst., Calif.
ADVANCED ENGINEERING RESEARCH STUDY OF METHODS AND EQUIPMENT FOR HIGH-LEVEL SINGLE-SIDEBAND GENERATION, by J. F. Honey, D. K. Reynolds, and D. K. Weaver, Jr. Final rept. for 1 June 50-31 July 51 on Contract DA 36-039-sc-78. 15 Feb 52, 198p. ATI-152 671.
Order from LC mi$8.70, ph$30.30 PB 137 200

A transmitter has been constructed which incorporates the latest work on the high-level system and includes completely automatic tuning. The principal aims in constructing this transmitter have been those of improving the performance of the system and simplifying its design and operation.

Stanford Research Inst., Menlo Park, Calif.
PREPARATION OF STANDARDS AND TEST PROCEDURES FOR PRINTED CIRCUITS, by C. A. Dodge, S. E. Graf, and W. W. Hansen. Rept. on Improved Electronic Components, Contract AF 33(616)2762. Oct 58, 119p. 2 refs. WADC Technical rept. 57-325, Suppl. I; AD-202 551.
Order from OTS $2.50 PB 131 983S

This report describes a program of research and development which facilitated the preparation of military specifications for multiple-contact printed circuit connectors. In addition, the initial phases of a similar program on printed circuit component-lead-terminations is described; this program was subsequently cancelled. Comprehensive questionnaires concerning the field performance of printed circuit connectors and terminations and laboratory techniques for testing them were distributed nationally to commercial firms. Results from these questionnaires were used in planning the laboratory phases of the program. Samples of multiple-contact connectors suitable for incorporation in printed circuit assemblies were purchased from representative manufacturers. These were evaluated in the laboratory and specification limits were derived from their performance. In turn, these limits were incorporated into two tentative military specifications for printed circuit connectors. Where existing methods of testing connectors were not adequate to fully evaluate printed circuit connectors--which are unique in some respects--new, more suitable, test procedures were developed. The properties most important for printed circuit connectors used in military equipment were established; the specifications prepared contain a test procedure and a quality assurance limit for each such property.

Tracerlab, Inc. [Boston, Mass.]
INVESTIGATIONS ON UTILIZATION OF RADIOACTIVE ENERGY AS A SOURCE OF BATTERY POWER, by Alexander Thomas. Quarterly rept. no. 2, 1 Nov 54-31 Jan 55, on Contract DA 36-039-sc-64519. 48p. AD-63 661.
Order from LC mi$3.30, ph$7.80 PB 137 356

United States Testing Co., Inc., Hoboken, N. J.
CAPACITORS, FIXED PAPER DIELECTRIC MOLDED TUBULAR, by E. P. Howard. Final engineering rept. for 1 July 52-30 June 54 on Contract DA 36-039-sc-42531, Task 2. 91p.
Order from LC mi$5.40, ph$15.30 PB 138 940

[Varo Mfg. Co., Inc., Garland, Tex.]
INSTRUCTION BOOK FOR GLIDE SLOPE RECEIVVER TYPE RUS. Rept. on Contract Cca-28285. 21 Feb 50, 56p.
Order from LC mi$3.60 ph$9.30 PB 132 483

Ordnance, Missiles, and Satellite Vehicles

Air Force Cambridge Research Center, Bedford, Mass.
EVALUATION OF SATELLITE OBSERVING NETWORK FOR PROJECT "SPACE TRACK", by G. R. Miczaika and H. O. Curtis. June 58, 30p. 2 refs. Air Force Surveys in Geophysics no. 101; AFCRC TN-58-416; AD-152 581.
Order from LC mi$2.70, ph$4.80 PB 135 879

This paper presents a discussion on (a) the techniques available for observing the position of a satellite, (b) the accuracy of these techniques, and (c) the present status of the observational program utilized by the AF Cambridge Research Center's Project "Space Track." In addition, recommendations are made for extension of the optical, radio, and radar networks.

Air Force Missile Development Center, Holloman AFB, N. Mex.
SOLID TRACK LUBRICATION AND SLIPPER DESIGN, by Heinz T. Schwinge. May 58, 31p. 6 refs. AFMDC TN-58-8; AD-154 100.
Order from LC mi$3.00, ph$6.30 PB 135 495

Wear experiments conducted during Jan-Feb 57 with six monorail sleds on 5000 feet of highspeed test track are described. During these tests the rails were (a) not treated, (b) coated with lead powder, or (c) coated with molybdenum-disulfide. Coating was done by Electrofilm Inc. of North Hollywood, Calif. Evaluations of slipper wear, based on only two tests for each rail condition, indicated a considerable decrease in wear with lead-coated rails and no appreciable difference in wear between untreated rails and rails treated with MoS_2. This report recommends continuation and expansion of the test program using solid lubricants, and presents a number of slipper-configuration changes designed to reduce wear.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMMENTS ON PROJECTILE JUMP, by Charles H. Murphy. Apr 57, 13p. 8 refs. Memo. rept. no. 1071; AD-132 323.
Order from LC mi$2.40, ph$3.30 PB 137 307

Relations for aerodynamic jump and blast jump are derived from the linear theory. Although most of the conclusions are not new, the derivations provide additional insight into the problem.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A CRITICAL INVESTIGATION OF SEVERAL HIGH-SPEED PHOTOGRAPHIC TECHNIQUES FOR EVALUATING THE LETHALITY OF LINED CAVITY CHARGES, by John H. Kineke, Jr. Dec 56, 30p. 11 refs. Memo. rept. no. 1054.
Order from LC mi$2.70, ph$4.80 PB 137 305

This report presents critical evaluations of seven high speed techniques which might be used for photographing shaped charge jets and spall fragments. The project was undertaken with the intention of using one of these techniques for recording and evaluating behind target lethality of lined cavity charges. The techniques discussed include three electronic shuttering devices. Of the seven tried, the Kerr cell camera was found to be the one most effective for photographing jet-produced fragmentation.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ENERGY PARTITION IN THE EXPLODING WIRE PHENOMENON, by F. D. Bennett. Oct 58, 30p. 5 refs. Rept. no. 1056.
Order from LC mi$2.70, ph$4.80 PB 137 814

Streak camera and oscillographic circuit damping data are presented for copper wires varying in diameter from 3 to 8 mils. Discussion of the implications of the Taylor-Lin similarity theory indicates that lack of similarity of the flow is probably connected with the displacement of the maximum energies associated with shock wave and contact surface.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
MEASUREMENT OF PROJECTILE MOTION DURING ENGRAVING PROCESS, by J. A. Petersam, H. G. McGuire, and T. E. Turner. May 57, 50p. 7 refs. Memo. rept. no. 1070.
Order from LC mi$3.30, ph$7.80 PB 137 306

Position-time measurements were made at 0.1 inch intervals during the first four inches of travel of 105mm. projectiles fired at Zones I, III, V, and VII. These, together with pressure-time measurements, were used to derive velocities, accelerations and frictional forces. The procedures and instrumentation used to perform this experiment are described.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
VELOCITY LOSSES OF CYLINDRICAL STEEL PROJECTILES PERFORATING MILD STEEL PLATES, by R. L. Jameson and J. S. Williams. July 57, 35p. 6 refs. Rept. no. 1019.
Order from LC mi$3.00, ph$6.30 PB 137 308

Velocities of projectiles, after perforating steel plates, and of fragments from these plates, have been measured by use of a double spark photographic technique. Velocity loss of projectiles fired through thin mild steel plates was found to be independent of striking velocity. The loss in velocity of projectiles upon perforating thick steel plates increases with decreasing striking velocity in the region of the ballistic limit.

Equipment Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
REVIEW OF TECHNIQUES FOR MEASURING AND ANALYZING MISSILE VIBRATION, by V. C. McIntosh. Rept. on Environmental Criteria for Pilotless Aircraft. Feb 57, 27p. 5 refs. WADC Technical note 57-59; AD-118 146.
Order from LC mi$2.70, ph$4.80 PB 138 853

In the selection of instrumentation to measure and analyze missile vibration, factors peculiar to missile operation must be carefully considered. These factors are utilized to suggest guides to the instrument technician in obtaining the desired vibration data. Methods of data analysis are discussed which will yield a complete description of the vibration environment. Reliable measurements and complete analyses of this type are essential to form a basis for realistic vibration testing procedures.

Explosives Research Group, U. of Utah, Salt Lake City.
X-RAY TECHNIQUE FOR MEASURING DENSITY VS DISTANCE RELATIONSHIPS IN DETONATING EXPLOSIVES, by T. K. Collins. Technical rept. no. 53 on Contract N7onr-451(07). Sep 57, 31p.
Order from LC mi$3.00, ph$6.30 PB 135 718

[Feltman Research and Engineering Labs.] Picatinny Arsenal, Dover, N. J.
BIBLIOGRAPHY ON SILVER AZIDE, by Alfred M. Anzalone. Feb 58, 28p. 38 refs. Bibliography no. 5, part 1; AD-156 306.
Order from LC mi$2.70, ph$4.80 PB 138 130

This bibliography has been prepared as a preface to a twofold study to determine (a) the possibility of using silver azide as a replacement for lead azide in service ammunition and (b) the compatibility of silver azide with various metals currently used in detonator cups.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
EMISSION SPECTROGRAPHIC DETERMINATION OF METALLIC IMPURITIES IN POWDERED ALUMINUM, by Seymour Lader. Technical rept. 2535. July 58, 20p. 11 refs. Technical rept. 2535.
Order from LC mi$2.40, ph$3.30 PB 135 940

An accurate spectrographic method has been developed for the determination of the following elements in powdered aluminum: magnesium (0.07 - 1.0), chromium (0.07 - 1.0), silicon (0.07 - 1.0), titanium

(0.07 - 1.0), copper (0.07 - 1.0), calcium (0.07 - 1.0), lead (0.07 - 1.0), iron (0.13 - 1.0), zinc (0.13 - 1.3). Larger percentages can be determined by diluting the sample with pure aluminum oxide.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
A METHOD FOR DETERMINING THE MOISTURE CONTENT OF NON-LAMINAC TYPE PYROTECHNIC COMPOSITIONS, by Arthur R. Lusardi and Joseph Wingler. Aug 58, 27p. 5 refs. Technical rept. 2516.
Order from LC mi$2.70, ph$4.80 PB 137 577

Object was to develop a better method for determining the moisture content of several pyrotechnic compositions, generally of the non-laminac type. An adaptation of the Karl Fischer method was applied to 8 factory-prepared compositions representative in terms of their components of a group of 52 pyrotechnic compositions. Laboratory-prepared samples composed of inorganic salts and binders were also tested. In addition, all of the ingredients found in the 52 compositions were tested individually to observe whether any interfering reactions would take place between the Fischer reagent and the ingredients.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
POLAROGRAPHIC ANALYSIS OF PRIMER MIXTURE FOR FOR M60 BASE-DETONATING FUZE, by Charles Ribaudo and Delbert Cragle. Oct 58, 12p. 8 refs. Technical rept. 2549.
Order from LC mi$2.40, ph$3.30 PB 137 468

Rapid and reliable polarographic methods have been developed for the determination of trinitrotoluene and the simultaneous determination of antimony trisulfide and lead thiocyanate in the primer mix used in the M60 base-detonating fuze. The developed methods for the determination of trinitrotoluene, antimony trisulfide, and lead thiocyanate were found to have standard deviations of 0.05%, 0.09%, and 0.11%, respectively. The actual working time for the three determinations is 1.5 hours, and the overall time is 2.5 hours.

Naval Ordnance Test Station, China Lake, Calif.
METHOD FOR MAKING FUEL CELLS AND LINING ROCKET-MOTOR TUBES WITH ABSESTOS-REINFORCED PHENOLIC RESIN, by L. R. Dallett and W. E. Donaldson. Rept. for Feb-June 56. 15 Feb 58, 21p. NOTS-1723; NAVORD 5447.
Order from LC mi$2.70, ph$4.80 PB 137 124

In order to protect rocket-motor tubes against high temperatures during burning, a method of using asbestos-reinforced phenolic resin to line RARE and SIDEWINDER 1C test vehicles, and a means of making cells for RARE sustainer fuel for the same material were devised. The procedure for processing the materials, and the construction and operation of the apparatus for the molding of the liners and fuel cells are presented.

Naval Ordnance Test Station, China Lake, Calif.
A METHOD FOR THE CALCULATION OF THE JET FORCES ON A FOLDING FIN, by Robert P. Stein and L. M. Tannenwald. 22 June 55, 35p. NOTS-1148; NAVORD rept. 3517; AD-71 511.
Order from LC mi$3.00, ph$6.30 PB 137 820

A method for the calculation of the forces acting upon a fin immersed in a jet stream is presented. The method utilizes shock wave theory and is based upon the existence of a shock parallel to the leading surface of the fin. Experimental verification of the method is described which utilizes direct force and pressure measurements on a fin held in an air jet of Mach number comparable to that present in rocket jets. Examples of shadowgraphs taken to complement these measurements are included. A sample calculation of fin opening time is made for a hypothetical rocket.

Sanitation and Safety Engineering

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DESTRUCTION OF MICROORGANISMS IN WATER, SEWAGE AND SEWAGE SLUDGE BY IONIZING RADIATION (SALTY DOG VIII), by Harry N. Lowe, Jr., William J. Lacy and others. Rept. for Jan 54-July 56. Mar 57, 35p. Research rept. 1475-RR.
Order from OTS $1.00 PB 151 148

Samples of double-distilled water and autoclaved sewage were inoculated with appreciable doses of B. subtilis, var. niger spores, M. smegmatis, M pyogenes var. aureus, E. coli, and T-3 coli phage and exposed to gamma radiation from a 1.1 kilocurie source of cobalt-60. Samples of settled sewage and sewage sludge were similarly irradiated. All of the test organisms, when suspended in distilled water and in sterilized sewage, were destroyed by gamma radiation. The dosage for complete kill was high, ranging from 2.0×10^6 rad for B. subtilis var. niger spores to 7.5×10^4 rad for T-3 coli phage when suspended in distilled water. The samples of settled sewage and sewage sludge were sterilized by gamma radiation. The dosage required for 100 percent kill were 5.0×10^6 rad respectively. The dosage required for lower kills was materially less than for 100 percent kill. With the exception of B. subtilis var niger spores, the most resistant of the test organisms, kills up to 90 percent were achieved in water, settled sewage, and in sewage sludge at dosages no larger than 7×10^4 rad.

Dunlap and Associates, Inc., Stamford, Conn.
MANUAL FOR THE APPLICATION OF STATISTICAL TECHNIQUES FOR USE IN ACCIDENT CONTROL. I. HIGHWAY ACCIDENTS. II. INDUSTRIAL ACCIDENTS. III. EVALUATION OF SAFETY PROGRAMS, by Jack W. Dunlap. Rept. on Contracts DA 49-007-MD-(239, 678, 876). June 58, 75p.
Order from OTS $2.00 PB 151 055

In 1952, Dunlap and Associates, Inc., began a series of analytical and mathematical studies of accident causation sponsored by the Commission on Accidental Trauma of the Armed Forces Epidemiological Board.

Analytical methods developed and tested in this program are here made available to those safety administrators who are not mathematicians or statisticians.

Engineer Research and Development Labs., Fort Belvoir, Va.
REMOVAL OF RADIOLOGICAL WARFARE AGENTS FROM WATER (SALTY DOG V) by William J. Lacy and Don C. Lindsten. 22 Apr 55, declassified 23 Oct 57, 18p. 5 refs. Rept. no. 1396.
Order from LC mi$2.40, ph$3.30 PB 136 025

Six methods and percentages of removal are discussed.

Ship Building

David Taylor Model Basin, Washington, D. C.
TECHNIQUES FOR PROTECTING AND WATERPROOFING RESISTANCE WIRE STRAIN GAGES, by Mills Dean, III. Revised ed. Oct 57, 44p. 34 refs. TMB-797, rev.
Order from LC mi$3.30, ph$7.80 PB 137 546

This report describes new waterproofing techniques and materials for protection of strain gages and associated wiring. Certain synthetic rubber compounds and two wax products have been found to be very satisfactory waterproofing materials. Techniques for the use of these materials are described in detail.

Material Lab., New York Naval Shipyard, Brooklyn.
REPORT OF DEVELOPMENT OF WATER INDICATING PASTE FOR USE AT ELEVATED TEMPERATURES, by E. C. Haas. May 58, 9p. 9 refs. Lab. project 5403-1, Final rept.
Order from OTS $0.50 PB 151 127

This report covers the development of a water indicating paste for use in detecting leaks in pressure vessels at temperatures up to 500°F. The formula developed has been laboratory tested to show that it reacts with hot or cold water to give a clearly discernible permanent color change and is essentially unaffected, in its water indicating properties, by 300 hours at 500°F or 300 hours at 100% relative humidity at ambient temperatures, and meets general requirements for an easily applied, adherent (although easily removed by wire-brushing), non-corrosive coating. The formula consists of equal parts of silver chromate and lead chloride mixed with sufficient thinned, phenolic-base, spar varnish to give a smooth paste of desired consistency.

Naval Civil Engineering Research and Evaluation Lab., Port Hueneme, Calif.
EXPERIMENTAL DETERMINATION OF THE NATURAL PERIOD OF OSCILLATION IN SURGE AND SWAY OF AN AFDL-20(1000-TON FLOATING DRY DOCK) AS SPREAD MOORED FORE AND AFT IN LIGHT CONDITION, by J. T. O'Brien and W. D. Lash. 1 Sep 56, 55p. 7 refs. Technical memorandum M-120.
Order from LC mi$3.60, ph$9.30 PB 136 107

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Food

Army Medical Nutrition Lab., Denver, Colo.
SHORT-TERM HUMAN FEEDING STUDIES OF FOODS STERILIZED BY GAMMA RADIATION AND STORED AT ROOM TEMPERATURE, by Edwin L. Bierman, Irvin C. Plough and others. June 58, 28p. 29 refs. Rept. no. 224.
Order from OTS $0.75 PB 151 152

The present report describes the results of the sixth and seventh short-term human feeding studies of irradiated food items. Eighteen different foods were tested in these studies, all stored at room temperature for approximately three months after irradiated and stored at room temperature prior to testing to a total on nineteen. All of these foods were found to be bacteriologically sterile and nontoxic in animals prior to use.

Army Quartermaster Corps, Washington, D. C.
RADIATION PRESERVATION OF FOOD. 1 Aug 57, 461p. 2103 refs. U. S. Army Research and Development Series no. 1.
Order from OTS $5.00 PB 151 493

Illinois U., Urbana
THE PHYSIOLOGICAL BASIS FOR VARIOUS CONSTITUENTS IN SURVIVAL RATIONS. PART II. THE EFFICIENCY OF YOUNG MEN UNDER CONDITIONS OF MODERATE COLD, by Frederick Sargent, II, Virginia W. Sargent and others. Rept on Flight and Survival Foods, Feeding Methods, and Nutritional Requirements, Contract AF 18(600)80. May 55, 400p. 83 refs. WADC Technical rept. 53-484, pt. II; AD-78 282.
Order from LC mi$11.10, ph$60.60 PB 137 374

From February 22, 1954, through April 4, 1954, 87 volunteer airmen and 12 volunteer non-commissioned officers served as subjects in a study of survival rations in moderate cold. To establish physiological, biochemical, nutritional, and clinical judgments on the relative effects of work, water, calories, and protein/carbohydrate/fat ratio in all-purpose survival rations, numerous observations were made in two-week periods of adequate, restricted, and recovery diets, with luxus amounts of vitamins at all times. Starvation and a 3000-Calorie adequate ration represented the worst and best regimens. Twenty nutrient combinations could be rank-ordered, by 21 different tests, with respect to effects on organ function and body efficiency. Clinical findings could also be rated. Below the 3000-Calorie control ration, the highest score was attained both in hard work and in light work by a combination supplying unlimited water, 2000 Calories per day, and a distribution of calories of 15% protein, 52% carbohydrate, and 33% fat. Limitation of water,

decrease of calories, or marked deviations in protein/carbohydrate/fat ratios resulted in measurable clinical or functional deterioration.

Laboratory of Vitamin Tech., Inc., Chicago, Ill.
USE OF ADDITIVES IN ELIMINATING THE UNDESIRABLE EFFECTS OF IONIZING RADIATIONS, by Lawrence Rosner. Rept. no. 7 (Final), 1 July 55-31 Oct 56, on Contract DA 19-129-qm-389. Nov 56, 49p. 7 refs.
Order from OTS $1.25 PB 131 954

Covers flavor studies, texture changes, expressible fluid, and relative importance of presence of air and moisture.

Packaging

Battelle Memorial Inst., Columbus, Ohio.
SURVEY OF INSTRUMENTATION APPLICABLE TO PACKAGING RESEARCH, by H. M. Morgan, G. A. Waldie, and R. M. Conklin. Final technical rept. 31 May 52, 37p. 43 refs.
Order from LC mi$3.00, ph$6.30 PB 136 136

This is a report on a survey conducted as part of a larger program of investigation of packaging-engineering fundamentals currently being conducted by the Packaging Development Branch of the Engineer Research and Development Laboratories. As background for the discussion of instrument components, the report considers various aspects of military packaging problems. A portion of the report is devoted to outlines of package tests.

Bjorksten Research Labs., Inc., Madison, Wis.
EVALUATION OF TRANSPARENT MATERIALS FOR PACKAGING OF REPAIR PARTS, by Luther L. Yaeger and Risto P. Lappala. Final rept. for 1 Aug 55-31 May 56 on Contract NObs-72006. May 56, 94p. (6 figs. will not reproduce)
Order from LC mi$5.40 ph$15.30 PB 138 029

Based on evaluation of published data and the results of laboratory screening and accelerated exposure tests, transparent materials were rated for packaging seven groups of repair parts requiring different degrees of protection. A graphical method was devised which offers a tool for rapid manual matching of the protection requirements of repair parts with the properties of packaging materials.

Florida U. Engineering and Industrial Experiment Station, Gainesville, Fla.
TRANSPORTATION SHOCK AND VIBRATION STUDIES, by D. A. Firmage. Final rept. on Contract DA 44-009-eng-460. [1951] 82p. 17 refs.
Order from LC mi$4.80, ph$13.80 PB 139 262

Most all shock and vibration tests that have been conducted to date have been confined to transportation of items of a limited nature (particularly electronic equipment). As a result of this study recommendations are given: a technical committee of engineers be formed to plan and coordinate all research in this field; additional tests should be conducted on all forms of transportation; an investigation should be made to determine the characteristics of shock and vibration that are damaging to lading; future tests on shock and vibration in carriers should employ an acceleration time record.

Florida U. Engineering and Industrial Experiment Station, Gainesville.
TRANSPORTATION SHOCK AND VIBRATION STUDIES, by D. A. Firmage. Final rept. (Supplemental) on Contract DA 44-009-eng-460. 25 Feb 52, 58p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 139 262-S

Ground handling tests were drop tests performed on four unpacked units of electronic equipment ranging in weight from 7 3/4 pounds to 65 pounds, one packaged unit weighing 73 pounds gross and three components ranging in weight from 2 pounds to 10 3/4 pounds. All of the units, except the packaged unit were dropped from heights of 14 inches, 28 inches, and 42 inches on packed earth, wood, and concrete. The instrumentation employed were six accelerometers connected to a Oscillograph.

Forest Products Lab., Madison, Wis.
THE CUSHION FACTOR-STRESS CURVE AND ITS VALUE FOR CLASSIFYING AND SELECTING PACKAGE CUSHIONING MATERIALS, by R. K. Stern. Rept. for Aug 57-Nov 57 on Finishing and Materials Preservation, Contract [AF] 33(600)53-4023. Nov 58, 51p. 6 refs. WADC Technical rept. 58-223; AD-205 071.
Order from OTS $1.50 PB 151 547

"Cushioning factor-stress" curves have been considered for use in solving package cushioning problems and for classifying package cushioning materials. To be most suitable for these uses, a single essentially constant curve would express the compressive efficiency of any specific material regardless of its dimensions or loading rate. The dynamic compression test data derived from this work showed that the curve for at least one important material varies considerably with thickness, and the use of this type of curve is considered to be impractical. The report contains data for the compressive efficiency and variability of four common kinds of package cushioning materials differing in thickness, density, and manufacturing origin.

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
HUMIDITY SENSING AND RECORDING DEVICES, by Edward Cohn, Jr. Progress rept. Aug 53, 6p. WCRT TN-53-172; AD-50 381.
Order from LC mi$1.80, ph$1.80 PB 136 299

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Air Products, Inc., Emmaus, Pa.
DESIGN AND PERFORMANCE OF TYPE MD-1 LIQUID OXYGEN STORAGE AND SERVICING SEMITRAILER, by S. L. Feldhan. Rept. on Contract AF 33(600)24077. Nov 56, 156p. 103 refs. WADC Technical rept. 55-448; AD-116 543.
Order from LC mi$7.50, ph$24.30 PB 137 205

Design of a Liquid Oxygen Storage and Servicing Semi-Trailer, capable of transporting 3800 gallons of liquid oxygen and pumping from the tank at a rate of 250 GPM against a pressure head of 100 PSIA is described. The design is in accordance with the Air Force Specification WCLEF-348 of September 15, 1952, amended January 18, 1954. The design of components is discussed, including physical data and arrangement of components. The performance of the liquid oxygen storage and servicing semi-trailer was checked, and all data taken is included in this report. It is concluded that the semi-trailer will function as required by the Air Force Specification WCLEF-348 of September 15, 1952, amended January 18, 1954.

Engines and Propulsion Systems

Aeronautical Research Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
ORBITAL STORAGE OF CRYOGENIC FLUIDS, by Kenneth R. Cramer. Rept. on Aviation Fuels. Oct 58, 13p. 2 refs. WADC Technical note 58-282; AD AD-203 527.
Order from OTS $0.50 PB 151 544

A radiative heat transfer analysis of large spherical liquid hydrogen storage vessels located in an equitorial orbit is presented. The results demonstrate that simple multi-layer reflective type shielding is sufficient to maintain moderate yearly liquid hydrogen losses. It is concluded, therefore, that research specifically in the heat transfer area is nor required for the development of suitable storage containers.

Aeroproducts Div., General Motors Corp., Dayton, Ohio.
GENERALIZED DESIGN CRITERIA FOR TURBO-PROP POWER CONTROL SYSTEMS, by William A. Buss. 19 June 56, declassified 5 Sep 57, 65p. Engineering rept. no. 1048.
Order from LC mi$3.90, ph$10.80 PB 136 195

This report develops generalized design criteria for comparing turbo-prop control system with direct coupled, split compressor, or gas coupled power sections. The criteria are divided into four (4) general categories of comparison, namely: Performance, Reliability, Maintainability, and Ease of Operation.

Battelle Memorial Inst., Columbus, Ohio.
USE OF CERAMIC LININGS TO REDUCE AFTERBURNER PRESSURE LOSS, by Herbert R. Hazard and Richard W. Niewoehner. Final technical rept. for 2 Jan 54-31 Mar 55 on Gas Turbine Technology, Contract AF 33(616)2220. June 55, declassified 6 June 56, 24p. 6 refs. WADC Technical rept. 55-276; AD-95 562.
Order from LC mi$2.70, ph$4.80 PB 136 408

Afterburner models of 10.5-in. diameter were tested to compare performance of sheet-metal models with that of ceramic-lined models. It was concluded that the effectiveness of the ceramic lining for flame holding was not great enough to justify further evaluation.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SOLUTION OF THERMOCHEMICAL PROPELLANT CALCULATIONS ON HIGH-SPEED DIGITAL COMPUTER, by Arthur J. Donegan and Milton Farber. Rept. on Contract DA 04-495-ORD-18. 13 Sep 55, 22p. 3 refs. Memo. no. 20-114.
Order from LC mi$2.70, ph$4.80 PB 139 031

The problem of carrying out performance calculations on rocket fuels has been solved on a high-speed digital computer. Mathematically the problem resolves to the simultaneous solution of a group of nonlinear algebraic equations which yield gas composition, flame temperature, average molecular weight, exhaust velocities, and other performance parameters. A three-cycle iterative scheme has been developed for the simultaneous solution for the various components involved in chemical combustion phenomena. Following the iteration, a straightforward computation obtains the performance parameters. With the present floating-decimal programming, the digital computer provides a complete solution for propellant performance calculations in an average time interval of approximately 30 minutes. The computing time previously required for the solution of these problems by desk calculation was measured in terms of days. Introduction of fixed-decimal methods would diminish the average time required per solution to approximately 5 minutes.

National Advisory Committee for Aeronautics, Washington, D. C.
METHOD FOR DETERMINING THE NEED TO REWORK OR REPLACE COMPRESSOR ROTOR BLADES DAMAGED BY FOREIGN OBJECTS, by Albert Kaufman. Sep 58, 25p. 3 refs.
Order from NASA NACA TN-4324

This method includes the effects of the location and depth of damage, the material fatigue strength and notch sensitivity, and the maximum-vibratory-stress level of the blade in engine operation. The method was compared with experimental results from fatigue tests of blades edge-nicked in the laboratory and was found to be an acceptable basis for blade inspection. The amount of strength restored by reworking the damaged area was also investigated.

National Bureau of Standards, Washington, D. C.
USE OF PARALLEL THERMOCOUPLES IN TURBOJET ENGINES, by Andrew I. Dahl and Ernest F. Fiock. Rept. on Contract [AF](33-038)51-4063E. July 51, 24p. AF Technical rept. no. 6546; AD-119 899.
Order from LC mi$2.70, ph$4.80 PB 137 258

The use of parallel thermocouples in turbojet engines is desirable because such networks continue to indicate temperature until the last junction fails. This report reviews the principles of parallel networks, presents theoretical and experimental data showing the temperature errors which may be encountered and suggests modifications under which the thermometric errors would be held within more reasonable tolerances.

National Bureau of Standards, Washington, D. C.
WEIGHTING ERRORS IN THERMOCOUPLE HARNESSES, by G. Frederick Blackburn. Rept. on Temperature Sensing Systems, Contract AF 33(616)53-1. Nov 57, 51p. 3 refs. WADC Technical rept. 56-639; AD-110 653.
Order from LC mi$3.60, ph$9.30 PB 137 770

The electrical characteristics of ladder-type thermocouple harnesses are described in general terms, followed by detailed analysis of several circuits. For purposes of analysis all harnesses are assumed to have five thermocouples. The circuits considered are both of the open and closed kind, and the analysis, or calculation of weighting factors, is carried out for two or more ways of connecting the measuring instrument in each of these two kinds. The effect of thermocouple burn-out is discussed. An analog circuit for representing ladder-type harnesses was constructed. It was used to verify the principal calculated results.

Naval Air Missile Test Center, Point Mugu, Calif.
TESTS OF TWO MODELS OF ECLIPSE-PIONEER ROCKET-DRIVEN TURBO-PUMPS, by R. Tearn. 20 Mar 49. Declassified. 54p. Technical rept. no. 42.
Order from LC mi$3.60, ph$9.30 PB 137 718

Two models of Eclipse-Pioneer rocket-driven turbo-pumps have been tested for the purposes of determining their drag in the jet of a 220-pound thrust acid-aniline rocket motor and evaluating their endurance. Both turbo-pumps were found to perform satisfactorily and both produced drags which ranged from four to eight percent of the gross thrust of the rocket motor.

Power Plant Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
GENERALIZED TURBOJET PERFORMANCE EQUATIONS FOR IBM CALCULATION, by Victor P. Kovacik. 3 Mar 55, 23p. 5 refs. Technical note WCLP 55-39; AD-60 092.
Order from LC mi$2.70, ph$4.80 PB 138 675

In evaluating propulsion and aircraft systems, it is often necessary to undertake parametric powerplant studies on short notice and with limited time available. The equations and methods presented below are intended to reduce the calculation effort and time usually associated with these studies.

Southwest Research Inst., San Antonio, Tex.
CONTINUED CALIBRATION AND PROCEDURE DEVELOPMENT STUDIES ON THE CLR ENGINE, by William P. Teich. Rept. on Contract DA 23-072-ORD-1144. Mar 58, 92p.
Order from LC mi$5.40, ph$15.30 PB 135 695

To determine the optimum degree of repeatability and reproducibility obtainable with the CLR oil test engine, three laboratories, which had reported low, medium, and high bearing corrosion in the recent 1957 Cooperative program, conducted a series of four tests using common fuel, lubricants, and procedures. The results of these tests indicate an improvement of 58.9 percentage points in test reproducibility over the 1957 program. Three tests were conducted to increase the bearing corrosion severity level by reducing the oil sump charge. These tests, using strip heaters attached to a single-wall oil pan, did not appreciably increase the test severity level over that with the external immersion heater.

Machine Parts and Mechanisms

Detroit Arsenal, Center Line, Mich.
LIFE TEST OF EXPERIMENTAL DIAPHRAGM MATERIALS, by Alex M. Calaluca. Final rept. 29 July 57, 35p. Rept no. 3945.
Order from LC mi$3.00, ph$6.30 PB 137 527

Ascertain the fatigue life and rate of gum formation in gasoline for three experimental and one commercially available diaphragm materials under extreme operating conditions.

Naval Engineering Experiment Station, Annapolis, Md.
"FALSE BRINELLING" OF BUSHINGS SERVING AS RACES IN VIBRATION DAMPERS OF DIESEL ENGINES. TEST TO DEVELOP A RELIABLE TYPE OF DAMPER BUSHING; ROLLER COMBINATION, by A. T. Church and D. H. Clark [10 Mar 44] 25p. Test C-338.
Order from LC mi$2.70, ph$4.80 PB 136 227

This test indicates that if failure of the beryllium copper bushings in the engine occurred under conditions of correct alignment of the bushing and pin, there probably existed a slight amount of slip between the pins and bushings, causing that form of wear called "false brinelling". A small imperfection so formed would propagate rapidly from the impacting of the pin in its race. It appears that bushings of hardened ball race steel or a material plated with porous hard chromium offer more superior resistance to false brinelling than do beryllium copper or Oilite bronze. It is understood that engine manufacturers now are using ball race steel successfully, so long as the design of the damping system is such that impacting of the pin in its bushing is eliminated.

[Army] Engineer Research and Development Labs., Fort Belvoir, Va.
EVALUATION OF THE SERVICE TEST OF AN OIL-FIRED BLACKSMITH FORGE, by I. S. Cassell. Final rept. on Maintenance Shop Equipment. 10 Aug 10 Aug 53, declassified 5 Nov 53. 36p. Rept. 1309.
Order from LC mi$3.00, ph$6.30 PB 139 038

From the standpoint of performance, ease of operation, maintenance, design, durability, ruggedness, safety, and transportability the oil fired blacksmith forge is a suitable replacement for the standard coal-fired forge.

Bulova Research and Development Labs., Inc., Woodside, N. Y.
CRYSTAL UNITS MANUFACTURE MECHANIZATION PROGRAL, by Robert J. Bibbero and Hans M. Wagner. Final rept. on System Study, Contract DA 36-039-sc-54667. 15 Nov 56, 163p. 8 refs. AD-132 813.
Order from LC mi$7.80, ph$25.80 PB 136 004

The development of a system and prototype equipments for a mechanized plant to manufacture CR-18/U and CR-23/U quartz crystal units at the rate of 200,000 per month with one-shift operation has been undertaken. This report finalizes the System Study and describes the processes and a man-machine system designed to achieve this goal.

California U., Los Angeles.
RESEARCH IN METHODS OF SCHEDULING A JOB SHOP (AN INFORMAL REVIEW) by Roger L. Sisson. Rept. on Management Sciences Research Proj. [Contract Nonr-223(02)]. May 57, 23p. 20 refs. Discussion paper no. 60; AD-134 050.
Order from LC mi$2.70, ph$4.80 PB 135 553

Scheduling of a job shop is studied to determine the sequence in which work should be performed to optimize a given factor. The factors considered are machines, job lots, due time, ready time, operations, processing time of operations, and minimum processing time. Objectives of optimal scheduling include minimization of total tardiness, maximum tardiness, in-process inventory cost, machine utilization, and the cost of being late. Mechanical and thermodynamic models of procedure are discussed as well as the waiting-line approach. The priority-function and the Berners-Lee methods are based on these models. The problem is discussed in terms of one-, two-, and three- or more-machine cases. The problems of experimentation in the field are discussed, and the Las Vegas approach is explained.

Detroit Arsenal, Center Line, Mich.
INVESTIGATION AND DEVELOPMENT OF A WELDING PROCEDURE APPLICABLE TO TITANIUM ALLOY ARMOR, by Donald E. Phelps. Final rept. 2 Aug 57, 33p. Rept. no. 3895.
Order from LC mi$3.00, ph$6.30 PB 136 429

Welding procedures were determined and employed in the fabrication of two "H" plates of a 7 percent manganese titanium alloy. Transverse weld cracks were detected in both plates. After weld repairs on "H" plate No. 1, the plate was submitted for ballistic impact tests. The No. 2 "H" plate was not successfully repaired.

Dow Chemical Co., Madison, Ill.
FORGING CHARACTERISTICS AND PROPERTIES OF HM21XA AND EK31XA MAGNESIUM ALLOY PRODUCTION FORGINGS, by J. F. Pashak. Rept. for 16 May 57-30 June 58 on Metallic Materials, Contract AF 33(616)3578. Nov 58, 171p. 22 refs. WADC Technical rept. 58-218; AD-204 797.
Order from OTS $3.00 PB 151 536

This production closed-die forging program was established for the purpose of determining the forging characteristics and properties of two high temperature magnesium alloys, HM21XA and EK31XA, in five sets of commercial design tools. Both cast and extruded material were used as forging stock. Test specimens for room and elevated temperature testing were taken from the forgings in normal production test locations after the HM21XA forgings were aged to the -T5 temper and the EK31XA forgings were heat treated to the -T6 condition. EK31XA alloy is readily forgeable in regular hydraulic presses and the Air Force heavy presses with stock temperatures of 750-950F and die temperatures of 700-850F. HM21XA alloy is relatively stiff to forge in this temperature range and the alloy is also susceptible to cracking when subjected to bending moments during the forging cycle. The cast forms of both alloys are slightly stiffer to forge than the extruded forms. The strength properties and creep resistance of EK31XA-T6 production forgings are outstanding at temperatures to 500F. Properties of HM21XA-T5 forgings, although lower than anticipated at moderate temperatures, duplicate those obtained on laboratory material at the higher testing temperatures. Optimum properties are obtained in this alloy by strain hardening and maintaining the Mn content at about 0.60%. Modulus, shear, bearing, and fatigue properties for both alloys are presented at appropriate testing temperatures.

Ford Motor Co., Dearborn, Mich.
IRON-ALUMINUM ALLOY SYSTEMS. PART 2. SOME INVESTIGATIONS IN AIR-MELTING AND APPLICATION OF IRON-ALUMINUM ALLOYS, by Joseph J. Clark and William J. Zager. Rept. for Apr 56-Mar 57 on Metallic Materials, Contract AF 33(600)32448. May 57, 54p. 7 refs. WADC Technical rept. 57-298, pt. 2; AD-130 824.
Order from LC mi$3.60, ph$9.30 PB 138 158

Alloys in the 6 to 10% aluminum range were air-melted in both induction and indirect-arc type furnaces. Mechanical properties were obtained on bar stock rolled from ingots. Beyond 9% aluminum, ductility of the air-melted alloys produced fell far below ductility reported for vacuum-melted alloys. Improved ductility of air-melted alloys will be dependent upon changes and improvements in deoxidation practice and in manner of introducing and mixing the aluminum with

the iron. No mold reactions were detected in casting the alloys in shell or CO_2-silicate bonded sands, and good casting finishes were obtainable. Severe cracking and hot-tearing tendencies were observed. Machining of as-cast alloys required slow cutting speeds. Severe tool wear was experienced. Susceptibility to corrosion will limit application in many heat-resisting services.

Ford Motor Co., Dearborn, Mich.
IRON-ALUMINUM ALLOY SYSTEMS, PART 3. WELDING OF IRON-ALUMINUM ALLOYS, by R. Burthwick and S. Goodman. Rept. for Apr 56 to Mar 57 on Metallic Materials, Contract AF 33(616)32448. May 57, 68p. WADC Technical rept. 57-298, pt. 3; AD-130 825.
Order from LC mi$3.90, ph$10.80 PB 137 503

Iron-aluminum alloys can be fabricated by welding. Precautions (preheat, postheat and close joint alignment) should be taken into consideration before this material is considered for high production applications. More engineering properties data are necessary.

Institute for Cooperative Research, Johns Hopkins U., Baltimore, Md.
FUNDAMENTAL CHARACTERISTICS OF HIGH CURRENT ARCS, by T. Benjamin Jones. Final rept. on Contract Nonr-248(09); Continuation of Contract N8onr-725(01). June 55. 69p. 56 refs. AD-65 795.
Order from LC mi$3.90, ph$10.80 PB 138 489

This report outlines the principal results of a study of some of the fundamental characteristics of high current arcs. The arcs studied were in the current range of 10-200 amperes direct current with virtually all tests made at atmospheric pressure. Much of the work was done in atmospheres of pure argon, helium and neon and in various mixture combinations of these three gases.

Metallurgical Research Labs., Syracuse U., N. Y.
DEVELOPMENT OF A PRACTICAL FORGEABILITY TEST, by George Sachs. Final rept. on Contract DAI 30-115-505-ORD(P)668. Dec 56, 37p. 29 refs. MET 369-575F.
Order from OTS $1.00 PB 151 153

This preliminary investigation indicates that the measurement of forging forces by means of a special die which simultaneously forges a steel specimen at elevated temperatures and a copper specimen at room temperature is practical and possible.

Zapffe, Carl A., Baltimore, Md.
EVALUATION OF PICKLING INHIBITORS FROM THE STANDPOINT OF HYDROGEN EMBRITTLEMENT. I: ACID PICKLING OF STAINLESS STEEL, by Carl A. Zapffe and M. E. Haslem. Rept. on [Contract N6onr-258 (01)]. [1948] 22p. 4 refs. AD-137 778.
Order from LC mi$2.70, ph$4.80 PB 138 626

By means of a special bend test, the field of commercial pickling inhibitors is surveyed from the standpoint of hydrogen embrittlement incurred during the pickling of stainless steel in sulfuric acid. Eleven inhibitors cause greater embrittlement than that incurred by pickling in raw acid; two neither increase nor decrease embrittlement beyond that caused by uninhibited acid; and only one, affords an improvement.

Sciaky Bros., Inc., Los Angeles, Calif.
IMPROVED METHOD OF EVALUATING SPOTWELD QUALITY IN TITANIUM ALLOYS. Supplement 1 to Progress rept. no. 8, 20 Dec 56-20 Apr 57 on Contract NOa(s) 55-954-c. 1 May 57, 18p.
Order from LC mi$2.40, ph$3.30 PB 136 397

A torsion shear test program was conducted with specimens comprised of 0.051-inch Alclad 2014-T6 and 0.064-inch Alclad 7075-T6 aluminum. This investigation was to determine the effect of the use of normal and high forge force during the welding sequence.

Westinghouse Electric Corp., East Pittsburgh, Pa.
THE PREPARATION AND PROPERTIES OF 14 TO 17 PERCENT ALUMINUM-IRON ALLOYS, by K. Foster and D. Pavlovic. Rept. on Solid State Research and Properties of Matter, Contracts AF 33(616)309 and AF 33(616)5555. May 58, 41p. 11 refs. WADC Technical rept. 58-391; AD-155 755.
Order from OTS $1.25 PB 151 472

Results of an investigation of 14 to 17 weight percent aluminum-iron alloys to develop high quality soft magnetic materials are summarized. General properties of high-aluminum iron alloys are presented and problems in the fabrication of the alloys to useful magnetic sheet are discussed. The effects of heat treatment on magnetic properties are described with particular emphasis placed on atomic ordering reactions occurring in the alloy system. Properties of low coercive force materials as well as materials with low residual induction are presented.

MATERIALS

Battelle Memorial Inst., Columbus, Ohio.
CONTINUOUS-TONE ELECTROSTATIC ELECTROPHOTOGRAPHY, by H. W. Albrecht, W. E. Bixby and others. Interim rept. no. 2 (Final) for 1 Jan-31 July 55 on Subcontract to Contract DA 36-039-sc-64581. 52p. AD-102 302.
Order from LC mi$3.60, ph$9.30 PB 137 197

During the six-month period covered by this report, considerable progress has been made toward the goal of designing the elements of an electrophotographic print processor. Uniform development over the entire 10 by 20-inch area of the electrophotographic plate area has been achieved using a moving-plat development system with a slot powder-entrance section.

Powder clouds of relatively fine grain have been supplied uniformly to the development area using a cloth-belt powder-cloud generator and a "T" classifier in the powder-transport section. Techniques have been devised to remove large particles from the powder cloud and to prevent the deposition of agglomerates of powder on the electrophotographic plate. Fairly reproducible reversal development can be obtained using the biased-electrode technique. The net result of these various advances is that positive electrophotographic prints of fair quality now can be produced with the laboratory-model print processor from negative silver halide transparencies. Further improvement can be expected as three new techniques used in this work are applied further. These techniques are: (1) the use of a particle impactor to sample the powder cloud at various points in the cloud to determine its size consist, (2) the use of a particle-size separator, and (3) the use of a powder-charge-measuring device. In addition, during this work period a beginning was made on a comparative evaluation of silver halide and electrophotographic prints. The optimum magnification for making such comparisons was found to be approximately 5 to 7 times. Work also was continued on the induction image-formation process of obtaining reversal electrophotographic prints.

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
SYNTHESIS OF HIGH IMPACT STRENGTH ADHESIVES FROM EPOXY RESINS, by Salvatore Stivala and Albert Resnick. June 58, 12p. 4 refs. Technical notes 17.
Order from OTS $0.50 PB 151 128

Object was to synthesize and evaluate epoxy resin adhesives that are liquids, cure at room temperature, and are highly resistant to impact between -65°F to 160°F. It was concluded that reactive epoxy resins can be synthesized from dihydroxydiphenyl sulfone and epichlorohydrin. These resins appear promising in adhesive applications.

Ceramics and Refractories

Alfred U., N. Y.
STUDY OF HEAT TRANSFER OF CERAMIC MATERIALS. PART I. ADAPTATION OF A MODIFIED ANGSTROM METHOD TO THE MEASUREMENT OF THERMAL DIFFUSIVITY OF NON-METALLIC MATERIALS, by Edwin J. Soxman. PART II. INFRARED TRANSMISSION AND RADIATION CONDUCTIVITY OF ALUMINA FROM ROOM TEMPERATURE TO 1800°C, by James E. Monroe, Jr. Final rept. for 1 Jan 55-30 Apr 57 on Contract Nonr-1503(02). 94p. 77 refs. AD-134 314.
Order from LC mi$5.40, ph$15.30 PB 136 851

A modified Angstrom method employs a long thin specimen subjected to a radiation boundary condition and upon which is impressed a sinusoidal temperature fluctuation at one end. The velocity of propagation and the attenuation of the resulting temperature wave are measured as it travels along the specimen. Thermal diffusivity for polycrystalline alumina range from 5.06 to 0.0073 cm^2/sec, in the temperature interval from 84° to 639°K. For mullite values range from 0.076 to 0.008 cm^2/sec, in the temperature interval from 82° to 355°K.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
COMPRESSIVE-CREEP PROPERTIES OF HIGH-TEMPERATURE MATERIALS, by L. A. Yerkovich and G. J. Guarnieri. Rept. on Metallic Materials, Contract AF 33(616)245. Nov 54, 53p. 15 refs. WADC TR-54-582; AD-73 859.
Order from LC mi$3.60, ph$9.30 PB 137 396

The high-temperature alloy and metal-ceramic materials in creep when subjected to static compression stresses in the temperature range of 1350 to 1800°F. Comparisons of the tensile and compression creep behaviors of the test alloys indicate that metals as well as metal-ceramic composites do not necessarily behave identically under static tension and compression stresses.

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
PORCELAIN ENAMEL DEFECTS: LITERATURE REVIEW AND DEFINITIONS, by Charles E. Collum, Gilbert Steiner, and T. Allan Wastler. Special rept. no. 1 on Contract NObs-66521. Sep 55, 123p. 415 refs. AD-109 499.
Order from OTS $2.75 PB 151 053

It is the purpose of this report to describe the defects in enamel coatings on steel plate as discussed in the literature and to report the suggested causes and prevention of defects. Phenomena associated with defects on sheet steel and stock of other metals have been reviewed. Over 100 separate names for enamel defects have been noted in this literature survey. In cases where there seems to be duplication, the authors have attempted to standardize the nomenclature by cross-indexing alternative names to the most descriptive and most popularly used terms.

Illinois U., Urbana.
STUDY OF FURNACE ATMOSPHERES AND INDUCTION HEATING IN THE FIRING OF PORCELAIN ENAMELS, by W. J. Plankenborn and Dwight G. Bennett. Rept. on Contract W33-038-ac-14520. Oct 52, 39p. 23 refs. WADC Technical rept. 53-61; AD-8249.
Order from mi$3.00, ph$6.30 PB 138 659

Firing was accomplished while the specimens were contained in a closed system, consisting of a glass tube with a suitable seal, and charged with a selected gas. The furnace atmosphere was found to affect the adherence, the surface characteristics and the bubble structures of porcelain enamels both on initial fire and on refiring. Volatilized materials were determined to be largely Na_2O and B_2O_3.

Illinois U. [Engineering Experiment Station] Urbana.
ALUMINUM TITANATE AS A POROUS INSULATING MATERIAL FOR THE PROTECTION OF METAL, by William F. Zimmerman, W. J. Plankenhorn and

Dwight G. Bennett. Rept. on Contract W33-038-ac-14520. 15 May 53, 20p. 3 refs. WADC Technical rept. 53-187; AD-14 763.
Order from LC mi$2.40, ph$3.30 PB 137 570

Aluminum titanate bodies of reasonable refractoriness and low density can be prepared by the addition of burn-out agents. Either sawdust or charcoal may be used as burn-out agents.

Illinois U. Engineering Experiment Station, Urbana.
METAL ALLOY AND TITANIUM METALLOID ADDITIONS TO REFRACTORY CERAMIC OXIDE BODIES, by Dwight G. Bennett and John W. Graham. Rept. no. 47 on Contract W33-038-ac-14520. 26 Sep 49, declassified 6 Dec 55, 19p. 2 refs. AF TR-6058; ATI-69 849.
Order from LC mi$2.40, ph$3.30 PB 137 490

Adherence of metal to ceramic materials is not necessarily dependent upon the degree of metal oxidation, or upon the degree of solid solution of the metal oxides in the ceramic oxides. Of the metal powders tested the 53% nickel-47% iron alloy developed best adherence on each ceramic oxide. The electrical resistance of sintered combinations of titanium nitride with alumina, magnesia, and zirconia is greatly affected by changes in their surface humidity.

Illinois U. [Engineering Experiment Station] Urbana.
METAL PROTECTIVE AND RADIATION REFLECTIVE CERAMIC COATINGS, by Clarence L. Hoenig, Tracy A. Willmore, and Dwight G. Bennett. Rept. on Ceramic Coatings, Contract AF 33(616)2307. Jan 56, 33p. 3 refs. WADC Technical rept. 56-140; AD-99 660.
Order from LC mi$3.00, ph$6.30 PB 137 571

Four matrix, or bonding, glasses and four refractory, radiation reflective ceramic aggregates were investigated. The radiation reflective components were fused magnesia, calcined diaspore, stabilized zirconia and calcined ceria. Calcined ceria was superior in properties of wettability stability, low solubility and sustained radiation reflection during long heating. When used with a matrix glass of proper thermal expansion, ceria aggregate coatings were found to function effectively in one coat application on Type 347 stainless steel.

Illinois U. [Engineering Experiment Station] Urbana.
METAL PROTECTIVE CERAMIC COATINGS: MOLECULAR BASIS, by Karl E. Nelson, George Don McTaggart, and Dwight G. Bennett. Final phase rept. on Contract AF 33(616)2307. Dec 55, 39p. 8 refs. WADC Technical rept. 56-136; AD-97 539.
Order from LC mi$3.00, ph$6.30 PB 137 716

Thirty ceramic frits and resultant coatings were subjected to cyclic heating for 200 hours at 1600°F. Coating durability was greatly dependent upon the crystal structure present, or developed within the coating glass. When, during the progress of the heating, many crystals formed, were absorbed, reappeared in shifted form and then, on occasion, disappeared completely the coating durability was very low. The very best coatings were those in which a relatively few crystals developed early and persisted unchanged through out the test. Procedures described, include X-ray techniques leading to detection, identification and control of crystalline components.

Illinois U. [Engineering Experiment Station] Urbana.
RESISTANCE OF CERAMIC COATINGS TO ATTACK BY FUMING NITRIC ACID, by Basil Ohnysty, W. J. Plankenhorn, and Dwight G. Bennett. Memo. rept. no. 30 on Contract W33-038-ac-14520. Sep 53, 18p. 2 refs. WADC Technical rept. 53-315; AD-21 920.
Order from LC mi$2.40, ph$3.30 PB 137 280

A method for determining the resistance of ceramic coated specimens to attack by hot fuming nitric acid is described. Ceramic coatings can protect steel from attack by fuming nitric acid at 160°F.

Illinois U. Engineering Experiment Station, Urbana.
SPECIFICATIONS FOR THE PREPARATION OF HEAT RESISTANT CERAMIC BASE COAT NO. 32-22 AND ITS APPLICATION TO STEELS OF LOW ALLOY CONTENT, INCONEL, AND ALLOY METALS OF THE STAINLESS STEEL TYPE, by Dwight G. Bennett. Memorandum rept. no. 19 on Contract W33-038-ac-14520. 21 Oct 49, 11p. AF Technical rept. no. 6060; ATI-74 499.
Order from LC mi$2.40, ph$3.30 PB 138 464

Preparation of heat resistant ceramic base coat No. 32-22 and its application to steels of low alloy content, inconel, and alloy metals of the stainless steel type.

Institute for the Study of Rate Processes, U. of Utah, Salt Lake City.
SOME OPTICAL PROPERTIES OF CORUNDUM, by J. Lambert Bates and Peter Gibbs. Technical rept. no. 5 on Contract Nonr-1288(03). 1 Aug 57, 16p. 16 refs.
Order from LC mi$2.40, ph$3.30 PB 136 153

The spectra of corundum (α-Al_2O_3), ruby, blue sapphire and golden sapphire are reported from 0.210 μ to 15 μ. Color centers are found in some crystals as received. They are also induced by x-rays and by heating in oxygen above 1300°C.

New Jersey Ceramic Research Station, Rutgers U., New Brunswick.
REFRACTORY INSULATING COATINGS FOR METAL, by John H. Koenig. Rept. no. 16 (Quarterly rept. no. 11) 1 Apr-1July 49 on Contract W33-038-ac-15800. Feb 50, declassified 6 Dec 55, 10p. AF TR-6048; ATI-67 972.
Order from LC mi$1.80, ph$1.80 PB 137 488

New York State Coll. of Ceramics, Alfred U.
IMPACT TESTING OF CERMETS, by Edward J. Soxman, M. T. Curran, and James R. Tinklepaugh. Rept. for 15 Apr 54-1 May 55 on Cermet Turbine Blading Program, Contract AF 33(616)2380. June 55, 84p. 10 refs. WADC Technical rept. 55-203; AD-92 584.
Order from LC mi$4.80, ph$13.80 PB 138 671

Impact tests were conducted upon nickel-bonded titanium carbide cermets at both room temperature and at 1800°F. The specimens were held as a cantilever in a vise and subjected to repeated blows of increasing intensity at their free ends. A new increment type impact test was developed in which the specimens were supported at their ends and subjected to impact loading at their midpoints by a freely falling hammer. For ten commercial and three nickel-bonded titanium carbide cermets the moduli of elasticity were determined as a function of temperature by a sonic method.

New Jersey Ceramic Research Station, Rutgers U., New Brunswick.
REFRACTORY PROTECTIVE COATINGS FOR METAL, by James W. Mulder and Frederick K. Davey. Rept. no. 18 (Annual rept. no. 3) for 1 Oct 48-1 Oct 49 on Contract W33-038-ac-15800. Declassified 6 Dec 55. 20p. AF TR-6050; ATI-67 973.
Order from LC mi$2.40, ph$3.30 PB 137 487

Studies of baria-alumina-silica glass and magnesium oxide-lithium coatings. A baria-alumina-silica glass coating was developed which will adhere to all portions of rotor turbine blades. A magnesium oxide-lithium fluoride coating was developed which may be applied to aluminized steel. The coating was applied to some low-carbon steel, and good adherence was obtained with good shock properties.

Ohio State U. Research Foundation, Columbus.
DEVELOPMENT, PROPERTIES AND INVESTIGATION OF A CERMET CONTAINING 28% ALUMINA AND 72% CHROMIUM, by Thomas S. Shevlin. Rept. on Contract AF 33(616)3. Dec 52, 58p. 11 refs. WADC Technical rept. 53-17; AD-4081.
Order from LC mi$3.60, ph$9.30 PB 137 385

The composition 72% chromium - 28% alumina, by weight, and related compositions, are described with respect to their preparation, testing, and behavior in certain investigations. Batches were prepared by wet ball-milling and the dried granules were formed into bar, tensile, and blade specimens by powder-pressing techniques in steel dies and/or by hydrostatic pressure. A marginal thermal-shock record of 450 cycles of simulated burner blow-out, a 1000-hour stress-rupture life of 15000 psi in air at 1800°F, and an impact resistance of the same order of magnitude as for potentially useful carbide-base cermets, combined with other test results, indicate the promise of this material for application in aircraft turbines.

Ohio State U. Research Foundation, Columbus.
EXPLORATORY STUDY OF THE METAL BONDING OF CORDIERITE AND STUPALITH, by Margaret Pausewang and Earle T. Montgomery. Rept. no. 70 on Contract AF 33(616) 3. July 52, 7p. WADC Technical rept. 52-189; ATI-168 239.
Order from LC mi$1.80, ph$1.80 PB 138 465

Due to the low melting temperatures of the two ceramic materials investigated, wetting of the components was not achieved and consequently a cermet body did not result.

Ohio State U. Research Foundation, Columbus.
PRELIMINARY MICROSCOPIC STUDIES OF CERMETS AT HIGH TEMPERATURES, by Thomas S. Shevlin, Herbert W. Newkirk and others. Rept. for 1 Mar 53-30 Sep 54 on Ceramic and Cermet Materials, Contract AF 33(038)16911. Feb 56, 142p. 37 refs. WADC Technical rept. 54-33, pt. 2.
Order from LC mi$7.20, ph$22.80 PB 136 184

Section 1 - Changes in the microstructure of some TiC base cermets, with time, at high temperatures
Section 2 - Study of some TiC base cermets by means of high temperature X-ray diffraction techniques
Section 3 - Electron microscopy of some TiC base cermets
Section 4 - Coefficient of expansion studies on high temperature alloys
Section 5 - Preparation of high Ni-low TiC cermets for impact and thermal shock studies
Section 6 - Investigation of TiB_2 and $MoSi_2$ as the ceramic component of a cermet
Section 7 - Study of the effect of heat treatment on impact strength of K-151-A and K-151-B

Pennsylvania State [U. Coll.] of Mineral Industries [University Park]
INVESTIGATION OF REFRACTORY MATERIALS. Memo. rept. no. 21 on Contract W33-038-ac-16374. Aug 49, declassified 7 Nov 51. 59p. AF Technical rept. no. 6054; ATI-79 231.
Order from LC mi$3.60, ph$9.30 PB 137 699

A review is presented of the progress accomplished in the development and study of refractory ceramic materials for aircraft power plant applications. The existence of aluminum titanate as a compound was confirmed, and extensive work was accomplished relative to the compounding of this material into a usable body. Numerous thermal expansion curves and a theoretical treatment of thermal expansion behavior are presented. Additional carbide systems were investigated in an unsuccessful attempt to form potentially useful binary compounds, and some work was done on metal-oxide systems.

Fuels, Lubricants, and Hydraulic Fluids

Army Ballistic Missile Agency, Huntsville, Ala.
PHYSICO-CHEMICAL PROPERTIES OF KEROSENE, by J. G. Tschinkel. Feb 56, 28p. 14 refs. C&F Memo. 46.
Order from LC mi$2.70, ph$4.80 PB 135 196

Specific gravity
Thermal expansion of liquid
Compressibility and thermal expansion of liquid and gas
Viscosity of liquid and vapor
Specific heat capacity
Enthalpy of vaporization
Enthalpy of combustion
Thermal conductivity
Vapor pressure
Critical temperature and pressure

Ballistic Research Labs., Aberdeen Proving Ground, Md.
THEORY OF THE RAPID BURNING OF PROPELLANTS, by John P. Vinti. Dec 52, declassified 6 Aug 57. 79p. Rept. no. 841.
Order from LC mi$4.50, ph$12.30 PB 137 128

The present report is a review, with certain original contributions, of the theory of the steady and rapid burning of solid propellants. The equations are expressed in terms of parameters familiar in interior ballistics. The whole treatment, which is rather elementary, covers the phenomenon of burning in considerable detail and that of detonation with enough detail to show how both phenomena correspond to the same fundamental equations. A more complete outline of the subject matter may be obtained by consulting the table of contents and the summary.

Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
METHODS OF INITIATING AND PREVENTING PROPAGATING EXPLOSIONS IN NITROMETHANE, by N. Kaplan, S. A. Johnston, and M. Weissbluth. Progress rept. no. 1-27 on Contract W535-ac-20260. 11 Apr 45, declassified 1 Dec 45, 48p. 3 refs.
Order from LC mi$3.30, ph$7.80 PB 137 700

North American Aviation, Inc., Downey, Calif.
SOME PHYSICAL MEASUREMENTS ON SHELL UMF GRADE C FUEL, by J. J. Hydock, D. E. Drysol, and R. V. Shelton. Rept. on Contract AF 33(600)28469. June 56, 14p. Rept. no. AL-2293.
Order from LC mi$2.40, ph$3.30 PB 135 699

The physical measurements included density, heat of combustion, kinematic viscosity, specific heat, aniline point, existent gum content, distillation and autogenous ignition.

Purdue U., Lafayette, Ind.
CHLORINE AND FLUORINE CONTAINING COMPOUNDS FOR NONFLAMMABLE MATERIALS, by Odgen R. Pierce and Earl T. McBee. Rept. on Hydraulic Fluids and Lubricants, Contract W33-038-ac-19024. May 53, 182p. 34 refs. WADC Technical rept. 53-79; AD-13 778.
Order from LC mi$8.40, ph$28.80 PB 139 025

A number of bromine-containing compounds were evaluated as snuffer additives in MIL-O-5606 fluid. The most effective materials for this purpose were found to be brominated aliphatic hydrocarbons of short chain length. For the studies of new base stock oils several new classes of fluorine and/or silicon containing materials were investigated. A series of compounds containing both silicon and phosphorus were synthesized and were found to possess good viscosity and non-flammability properties. Various fluorine-containing crotonyl and phosphonate ester systems were studied and the preparation and reactions of n-heptafluoropropyllithium investigated. The synthesis and evaluation of a fluorine-containing polyether and fluorine-containing silicate ester were also carried out.

[Research Inst.] U. of Michigan, Ann Arbor.
EFFECTS OF TURBULENCE AND WIND SPEED ON THE RATE OF EVAPORATION OF A FUEL SPRAY, by R. G. Fledderman and A. R. Hanson. Rept. on Contract NOrd-7924. 20 June 51, 109p. 63 refs. Rept. no. CM667.
Order from LC mi$5.70, ph$16.80 PB 135 913

This report describes an experimental investigation of the effect of turbulence and relative velocity upon the evaporation of a liquid-fuel spray.

Shell Development Co., Emeryville, Calif.
GREASE LUBRICATION OF HIGH SPEED ANTIFRICTION BEARINGS, by John B. Accinelli and Charles R. Greene. Rept. for May-Dec 54 on Lubricant Mechanical Evaluation, Contract AF 33(616)2443. July 55, 65p. WADC Technical rept. 55-102, pt. 1; AD-64 341.
Order from LC mi$3.90, ph$10.80 PB 138 656

A study of the failure mechanisms of grease lubricated antifriction bearings operating in the DN range from 1.0×10^6 to 2.0×10^6 was the main object of this project. All test work was conducted at the Shell Development Company using a rig designed by this company. After necessary rig development work and bearing selection tests, preliminary work on the effect of various grease and operational variables on the performance of ball bearings operating up to DN values of 1.5×10^6 was initiated.

Socony-Vacuum Labs., Paulsboro, N. J.
PHYSICAL AND THERMODYNAMIC PROPERTIES OF AIRCRAFT FUELS, by J. J. Brady. 31 Aug 53, 68p. Rept. no. 53.3-DM; AD-128 336.
Order from LC mi$3.90, ph$10.80 PB 136 723

Physical and thermodynamic data are presented on seven fuels; four gas turbine fuels, two aviation gasolines, and one motor gasoline. These data are intended for use in engineering and design work in connection with the storage, safe handling, and the utilization of aviation fuels.

Southwest Research Inst., San Antonio, Tex.
POLYNUCLEAR AROMATIC COMPOUNDS FOR HIGH TEMPERATURE LUBRICANTS, by Charles F. Raley, Jr. Rept. on Rubber, Plastic and Composite Materials, Contract AF 33(616)276. Feb 55, 54p. 7 refs. WADC Technical rept. 53-337, pt. 2; AD-61 592.
Order from LC mi$3.60, ph$9.30 PB 136 229

The properties of triaryl esters of phosphoric acid were studied with regard to their suitability as high-temperature lubricants and related materials. It was found that naphthyl derivatives did not have sufficient thermal stability to compensate for the unwanted increase in viscosity and melting point. The 4-biphenylyl group possessed all the advantages of the naphthyl group with much better thermal stability. One particular compound prepared, bis(o-chlorophenyl) 4-biphenylyl phosphate had a thermal stability of over 510°C (950°F), by far the highest stability of any compound prepared under this contract. It was found that the chlorophenyl phosphates possessed outstanding thermal stability and seemed to be the most promising type of compound for further development. It was found possible to vary considerably the physical properties of a compound by incorporating three different groups. Finally, the pronounced volatilizing and viscosity-reducing effect of the trifluoromethylphenyl group was observed in several compounds which contained one or more of these groups. It was also found possible to compile a table of approximate thermal decomposition temperatures of numerous aromatic groups.

Leather and Textiles

Materials Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
THE EFFECT OF SOLAR RADIATION ON THE BREAKING STRENGTH OF OUTDOOR EXPOSED WEBBINGS, by Robert A. Wilkinson. Rept. for July 55 July 55 - June 57, on Air Force Textile Materials. Nov 58, 58p. 2 refs. WADC Technical rept. 58-201; AD-206 893.
Order from OTS $1.50 PB 151 590

This program was to obtain data as to what degree solar radiation affected the breaking strength of webbings exposed to natural weather. Four groups of webbings were evaluated for breaking strength after being exposed to natural weather for specific time intervals encompassing one year. The exposure sites were Wright-Patterson Air Force Base, Ohio; Las Cruces, New Mexico; and College, Alaska. Data obtained indicate that the service life of the present type of runway barriers can be increased to 180 days in areas of extremely strong sunlight and to 360 days in areas of moderate or small amounts of sunlight by either one of the following two methods: (1) By using 260 denier 17 filament, Type 300, OD color nylon yarn in the manufacture of the webbing. (2) By using Type 330 nylon yarn in the manufacture of the webbing.

Southern Utilization Research and Development Div., Dept. of Agriculture, New Orleans, La.
DEVELOPMENT OF DURABLE FLAME-RETARDANT FINISHES FOR COTTON, by John G. Frick, Jr., Richard L. Arceneaux, and others. Rept. for July 56-Jan 58 on Air Force Textile Materials, Contract AF 33(616)56-59. Nov 58, 69p. 25 refs. WADC Technical rept. 58-130; AD-206 894.
Order from OTS $1.75 PB 151 550

New methods for imparting a durable, flame-retardant finish to cotton fabrics were investigated. Primarily, methods were sought for the chemical attachment of phosphorus-containing groups to cellulose. Classes of compounds investigated include: amides of phosphorus (V) acids; imides of phosphorus (V) acids; tetramethylphosphorodiamidic acid derivatives; phosphorus compounds containing epoxy groups; triazinylphosphonates; and phosphoroisothiocyanatidate derivatives. Also investigated were modifications of the phosphoric acid-urea process for the phosphorylation of cotton. The best finish developed was inferior in some respects to existing finishes.

Plastics

Battelle Memorial Inst., Columbus, Ohio.
NONDESTRUCTIVE TESTING OF PLASTIC-GLASS LAMINATES, by R. L. Gibbs, K. D. Cooley and others. Final rept. for 7 Apr - 7 Oct 52 on Contract NObs-55548. 31 Oct 52, 16p.
Order from LC mi$2.40, ph$3.30 PB 135 334

Feltman Research and Engineering Labs., Picatinny Arsenal, Dover, N. J.
HIGH RATE TENSION TESTER, by Stephen Strella, Mitchel Chmura and others. Aug 58, 15p. 3 refs. Technical rept. 2487.
Order from OTS $0.50 PB 151 151

A tension tester was developed which will fracture a sample in from 5 to 40 milliseconds. This high loading rate was achieved by suddenly releasing compressed gas into a cylindrical chamber to drive a piston attached to one end of the specimen.

Narmco, Inc., San Diego, Calif.
DESIGN DATA ON HIGH TEMPERATURE RESISTANT REINFORCED PLASTICS AND THE DESIGN, FABRICATION, AND EVALUATION OF A REINFORCED PLASTIC MISSILE COMPONENT, by Lowell O. North. Rept. on Contract AF 33(616)2583. Nov 56, 214p. WADC Technical rept. 56-355, pt. 1; AD-97 109.
Order from LC mi$9.60, ph$33.30 PB 136 544

A phenolic resin impregnated glass fabric material exhibiting superior physical properties at temperatures up to 850°F was developed during a materials screening program conducted to select promising high temperature structural plastics. Basic mechanical properties of this material were determined and design data on structural components such as sandwich cylinders and sandwich panels were obtained. This material was utilized in the design and fabrication of a 5' diameter by 8' long missile fuselage component. This compo-

nent, constructed as a plastic sandwich monocoque shell comprised of phenolic impregnated glass cloth skins and aluminum honeycomb core, resulted in a weight saving of 57% when compared with a metal structure designed to similar requirements. The component was fabricated by the Contractor and static tested at Wright Air Development Center using the loads and temperatures prescribed for the original missile. The plastic component successfully passed the entire static test program and was tested at 200% of ultimate load during the free flight-maximum temperature condition (650°F.).

Naval Ordnance Lab., White Oak, Md.
METHOD FOR DETERMINING THE EPOXY CONTENT OF CURED AND UNCURED RESINS, by Hugh C. Anderson. Aug 57, 19p. 6 refs. NAVORD rept. 5738.
Order from OTS $0.50 PB 151 150

A chemical method for determining the epoxy content of cured resins was modified so that it could be used as a tool in a study of mechanisms of cure of epoxy resins with amines. The usual acidimetric method of determining the epoxy content where amines are present is not satisfactory because of the buffering action of the amine hydrochlorides. This difficulty was circumvented by measuring the disappearance of chloride ions rather than consumption of the acid.

Rubber and Elastomers

Detroit Arsenal, Center Line, Mich.
A PHOTOMETRIC METHOD OF MEASURING OZONE SURFACE CRACKS IN RUBBER, by David K. Wilburn and Walter O. Perrott. Rept. no. 1, 8 June 56, 24p. Rept. no. 3568; AD-102 728.
Order from LC mi$2.70, ph$4.80 PB 137 532

Photometric evaluation of ozone cracks in rubber products affords an accurate means of quantitatively measuring the severity of ozone attack. Crack growth analysis of the test control samples by photometric means indicates that deterioration advances more rapidly during the first eight hours of exposure than during the last 16 hours. Comparison tests indicate that the photometric method of crack analysis is more accurate than visual evaluation.

International Latex Corp., Dover, Del.
DEVELOPMENT OF ELASTOMERS WITH IMPROVED PROPERTIES IN THE ABSENCE OF CARBON BLACK REINFORCEMENT, by Verle A. Miller, Edwin B. Gienger, Jr. and others. Final rept. for 1 July 54 - 25 May 56 on Contract DA 44-109-qm-1778. [1956]. 126p. AD-121 303.
Order from LC mi$6.30, ph$19.80 PB 139 045

Progress is reported for work accomplished on the following phases: (1) Preparation, compounding, and evaluation studies of butadiene/acrylonitrile/methacrylic acid terpolymers. (2) Effect of various monomers upon polymer homogeneity. (3) Effect of variation in structure of the acidic monomer. (4) Preparation and evaluation of other functional group - containing polymers.

[Rock Island Arsenal Lab., Ill.]
POLYURETHANE RUBBER BIBLIOGRAPHY, by R. Wadler. 2 Aug 55, 27p. 267 refs. RIA Lab. no. no. 55-2988.
Order from LC mi$2.70, ph$4.80 PB 135 702

References in this bibliography are divided into 2 main sections. The first section contains 141 references from the open literature on polyurethane rubber covering the period of February 1953 to June 1955. The references are arranged alphabetically according to author. The references in the second section are to patents; they are grouped alphabetically by country of origin and are arranged by ascending patent number. The patents are from Belgium, England, France, Germany, Italy, Japan, and the US.

MATHEMATICS

Air Force Missile Development Center, Holloman AFB, N. Mex.
METHOD FOR EXACT DETERMINATION OF THE COEFFICIENTS OF A LINEAR SYSTEM, by Guenter M. Schindler. Aug 58, 16p. 3 refs. AFMDC TN-58-14; AD-154 103.
Order from LC mi$2.40, ph$3.30 PB 136 054

This Note gives an exact method for finding the coefficients of a first-order linear system or those of an ordinary linear differential equation of arbitrary order. The desired coefficients, whether they are constant or time varying, are obtained from the solutions after application of a suitable delta-DIRAC disturbance. This method is applicable for real-time investigations.

Applied Mathematics and Statistics Lab., Stanford U., Calif.
REMARKS ON DE LA VALLEE POUSSIN MEANS AND CONVEX CONFORMAL MAPS OF THE CIRCLE, by G. Pólya and I. J. Schoenberg. Technical rept no. 70 on Contract Nonr-225(11). 28 Aug 57, 77p. 14 refs.
Order from L C mi$4.50, ph$12.30 PB 136 274

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOLUTION OF ORDINARY LINEAR DIFFERENTIAL EQUATIONS BY AN N STEP METHOD, by Joseph W. Fishbach. Aug 52, 25p. 2 refs. Technical note no. 720.
Order from LC mi$2.70, ph$4.80 PB 139 036

The purpose of this note is to outline an alternative procedure whereby the solution y may be obtained in

N steps without the necessity of finding the matrix A, or its inverse, A^{-1}. Since the matrix A is not required, the storage requirements are at a minimum, and the proposed method is ideally suited for high speed digital computers. If, in the equivalent algebraic problem, the system contains more equations than unknowns, then the proposed method will yield the most probable values of the unknowns as a least squares solution. The procedure to be given may be used for ordinary linear differential equations with constraints.

British Columbia U. (Canada).
DIAGONALS OF DOUBLY STOCHASTIC MATRICES, by Marvin Marcus and Rimhak Ree. Rept. on Contract AF 49(638)152. [1958] 12p. 6 refs. AFOSR TN-58-377; AD-154 284.
Order from LC mi$2.40, ph$3.30 PB 136 260

British Columbia U. (Canada).
NOTE ON GENERALIZED WITT ALGEBRAS, by Rimhak Ree. Rept. on Contract AF 49(638)152. [1958] 15p. 5 refs. AFOSR TN-58-376; AD-154 282.
Order from LC mi$2.40, ph$3.30 PB 136 261

British Columbia U. (Canada).
ON GENERALIZED CONJUGATE CLASSES IN A FINITE GROUP, by Rimhak Ree. Rept on Contract AF 49(638)152. [1958] 10p. 3 refs. AFOSR TN-58-378; AD-154 285.
Order from LC mi$1.80, ph$1.80 PB 136 258

British Columbia U. (Canada).
SIMPLICITY OF CERTAIN NONASSOCIATIVE ALGEBRAS, by Rimhak Ree. Rept. on Contract AF 49(638)152. [1958] 11p. 3 refs. AFOSR TN-58-379; AD-154 286.
Order from LC mi$2.40, ph$3.30 PB 136 259

California U., Berkeley
SIMULTANEOUS APPROXIMATION BY A POLYNOMIAL AND ITS DERIVATIVES, by Errett Bishop. Technical rept. no. 17 on Contract Nonr-222(37). Nov 57, 6p. 2 refs.
Order from LC mi$1.80, ph$1.80 PB 136 395

If f_0 is a continuous function on a compact set C without interior and with connected complement of the complex plane, and if $f_1, \cdots, f_n$ are continuous functions on a compact totally disconnected subset E of C, then there exists a sequence $\{p_i\}$ of polynomials such that $p_i \longrightarrow f_0$ uniformly on C as $i \longrightarrow \infty$, and $p_i^{[k]} \longrightarrow f_k$ uniformly on E as $i \longrightarrow \infty$, for $1 \leq k \leq n$, where $p_i^{[k]}$ is the kth derivative of p_i.

Carnegie Inst. of Tech., Pittsburgh, Pa.
NON-OSCILLATION THEOREMS FOR A CLASS OF NON-LINEAR DIFFERENTIAL EQUATIONS, by Richard A. Moore and Zeev Nehari. Technical rept. no. 23 on Contract AF 49(638)227. July 58, 35p. 5 refs. AFOSR TN-58-459; AD-158 266.
Order from LC mi$3.00, ph$6.30 PB 136 272

The differential equations to be considered in this paper are of the form $y'' + p(x)y^{2n+1} = 0$, where $p(x)$ is positive and continuous in $(0, \infty)$ and n is a positive integer.

Electronic Components Lab., Wright Air Development Center, Wright-Patterson AFB, Ohio.
PROOF OF RELIABILITY, by Frank J. Ruther and Larry D. Smith. Rept. for 12 May - 14 May 58 on Electronic Design Techniques. May 58, 9p. 6 refs. WADC Technical note 58-87; AD-151 119.
Order from LC mi$1.80, ph$1.80 PB 139 034

Proving reliability is considered from two distinct points of view: (1) the contracting agency and (2) the contractor. Statistical concepts of long standing are related to the problem of proving equipment reliability Various confidence levels are presented showing the relationship of confidence required to the cost of proving reliability. The same concepts are then transposed so that the contractor can compute his risk and calculate the cost of formal reliability testing.

Harvard U., Cambridge, Mass.
APPROXIMATION ON A LINE SEGMENT BY BOUNDED ANALYTIC FUNCTIONS: PROBLEM β, by J. L. Walsh. Rept. on Contract AF 18(600)1461. May 58, 7p. 2 refs. AFOSR TN-58-393; AD-154 302.
Order from LC mi$1.80, ph$1.80 PB 136 254

The following theorem is proved: Let D be a region of the z-plane bounded by a finite number of mutually disjoint Jordan curves C, and let E, $-1 \leq z \leq 1$ lie in D. Let the function u(z) be harmonic in D-E, continuous on the closure of D-E, equal to zero on E and unity on C. Let C_σ denote generically the locus $u(z) = \sigma$, $0 < \sigma < 1$, in D, and let D_σ denote generically the region $0 \leq u(z) < \sigma$ in D. Let f(z) be analytic throughout D_ρ, of class $L(p, \alpha)$ on C_ρ, $0 < \alpha < 1$, and suppose C_ρ is bounded and without multiple points. Then for every $\lambda \geq 1$ there exists functions $f_\lambda(z)$ analytic in D and satisfying the inequalities (1) $|f(z) - f_\lambda(z)| \leq Ae^{-\lambda\rho}/\lambda^{p+\alpha}$, z on E, and (2) $|f_\lambda(z)| \leq Ae^{\lambda(1-\rho)}/\lambda^{p+\alpha}$, z in D. Conversely, if f(z) is defined on E, if C_ρ is bounded and consists of a finite number of mutually disjoint Jordan curves, and if $f_\lambda(z)$ for every $\lambda \geq 1$ analytic in D and satisfying (1) and (2), then f(z) can be defined so as to be analytic throughout D_ρ, of class $L(p-1, \alpha)$, $0 < \alpha < 1$, on C_ρ.

Harvard U., Cambridge, Mass.
GENERALIZATION OF FABER'S POLYNOMIALS, by J. L. Walsh. Rept. on Contract AF 18(600)1461. May 58, 22p. 8 refs. AFOSR TN-58-417; AD-158 220.
Order from LC mi$2.70, ph$4.80 PB 136 250

Although the polynomials of Faber remain outstanding as the most useful polynomials for the expansion in an arbitrary Jordan region of the complex plane of a function analytic there, other kinds of polynomials (such as those found by interpolation) have

hitherto proved highly useful in the simultaneous expansion in several disjoint Jordan regions of a function analytic in those regions. It is interesting to note, and this is the purpose of the present paper, that Faber's original method applies also in the latter case, provided suitable modifications are made, and yields a new set of polynomials with important properties.

Harvard U., Cambridge, Mass.
INTEGRATED CONTINUITY CONDITIONS AND DEGREE OF APPROXIMATION BY POLYNOMIALS OR BY BOUNDED ANALYTIC FUNCTIONS, by J. L. Walsh and H. G. Russell. Rept. on Contract AF 18(600)1461. May 58, 30p. 22 refs. AFOSR TN-58-395; AD-154 304.
Order from LC mi$2.70, ph$4.80 PB 136 252

An analysis is given, with a minimum of detail, which shows that degree of approximation in the mean by polynomials in the complex variable and by bounded analytic functions is also conveniently investigated by use of integrated Lipschitz conditions. The investigation leads naturally to the use of classes of analytic functions satisfying integrated Zygmund and integral asymptotic conditions.

Harvard U., Cambridge, Mass.
ON CANONICAL CONFORMAL MAPS OF MULTIPLY CONNECTED REGIONS, by J. L. Walsh and H. J. Landau (Bell Telephone Labs., Inc., Murray Hill, N. J.). Rept. on Contract AF 18(600)1461. May 58, 26p. 3 refs. AFOSR TN-58-394; AD-154 303.
Order from LC mi$2.70, ph$4.80 PB 136 253

Institute of Mathematical Sciences, New York U., N.Y.
COEXISTENCE PROBLEM FOR HILL'S EQUATION, by Stanley Winkler and Wilhelm Magnus. Research rept. no. BR-26 on Contract AF 49(638)229. July 58, 94p. 47 refs. AFOSR TN-58-660; AD-162 191.
Order from LC mi$5.40, ph$15.30 PB 136 387

Hill's equation with a periodic coefficient of period π is investigated. The problem of the coexistence of two linearly independent solutions with period π or 2π is being considered, and all known cases in which such a coexistence occurs are shown to be special cases of a four-parametric equation which can be transformed into an equation of Hill's type. Also, the question of the existence of solutions admitting a terminating Fourier expansion is being investigated, and partial answers are being provided.

Louisiana State U., Baton Rouge.
DUOMORPHISMS AND CLANS ON AN INTERVAL, by Richard C. Phillips. Rept. on Contract AF 18(603)89. 20 Aug 58, 8p. AFOSR TN-58-710; AD-162 244.
Order from LC mi$1.80, ph$1.80 PB 136 391

The object of this paper is to characterize the clans (compact connected Hausdorff topological semigroups with an identity element) which are homeomorphic to a unit interval and which have a nondegenerate kernel (minimal two-sided ideal [1]). The corresponding case when the kernel is degenerate has been characterized in a paper by H. Cohen and L. I. Wade [2] together with an earlier paper by Mostert and Shields [5].

Michigan U., Ann Arbor.
POINCARE DUALITY IN HOMOLOGY MANIFOLDS, by F. A. Raymond. Rept. on Contract AF 49(638)104. [1958] 72p. 13 refs. AFOSR TN-58-457; AD-158 264.
Order from LC mi$4.50, ph$12.30 PB 136 247

Naval Ordnance Test Station, China Lake, Calif.
MANUAL AND BIBLIOGRAPHY OF THE APPLICATIONS OF ORTHOGONAL POLYNOMIALS TO LEAST SQUARES SOLUTIONS OF DATA-REDUCTION PROBLEMS, by Donald G. Duncan. 1 July 57, 38p. 30 refs. NOTS-1819; NAVORD rept. 5607.
Order from LC mi$3.00, ph$6.30 PB 137 509

The problem of fitting a polynomial to data by the method of least squares is reviewed. The method of approach to this problem using orthogonal polynomials is then discussed, and the advantages attending the use of these polynomials is emphasized. The report is primarily a manual, designed to instruct those who are encountering least squares methods for the first time. A table and an extensive list of references are supplied.

Numerical Analysis Research, U. of California, Los Angeles.
CONTINUED FRACTIONS. LECTURES GIVEN BY DR. E. FRANK, SUMMER 1957. Aug 57, 81p. 38 refs.
Order from LC mi$4.80, ph$13.80 PB 135 862

Consideration is given to some recurrence relations and definitions of continued fraction theory in general. A great deal of the material in these lectures can be found in Professor Oskar Perron's new books on continued fractions, and its use here is with Professor Perron's permission. In these books, many of the details and proofs, which have been omitted here, can be found. Since the theory covered here was discussed in only eight one-hour lectures, it is not to be construed as any complete theory of continued fractions. It is merely an introduction to the subject and a sample of some of the topics which are contained in the theory of continued fractions.

Ohio State U., Columbus.
THEORY OF ESTIMATION OF PARAMETERS FOR THE FUNDAMENTAL RANDOM PROCESS AND THE ORNSTEIN UHLENBECK PROCESS, by Henry B. Mann. Rept. on Contract AF 33(616)74. Mar 53, 63p. 4 refs. WADC Technical rept. 53-39; AD-14 990.
Order from LC mi$3.90, ph$10.80 PB 137 395

The theory is presented for the case when the mean value function is linear in the unknown parameters. Estimates are proposed for the unknown parameters, and their variances and covariances are derived. For

the fundamental random process, the proposed estimates for the parameters of the mean value function are shown to be best linear estimates, and for the Ornstein Uhlenbeck process, they are shown to be unbiased. If the mean value function is a polynomial or trigonometric polynomial, they are asymptotically best linear estimates. The cases considered include the estimate of periodic mean value function with known period.

Statistical Lab., U. of California, Berkeley.
ON THE CUMULANTS OF RENEWAL PROCESSES, by Walter L. Smith. Technical rept. on Contract Nonr-222(43). Sep 57, 62p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 135 742

Statistical Research Group, Princeton U., N. J.
WHERE DO WE GO FROM HERE? by John W. Tukey. Technical rept. no. 4 on Contract DA 36-034-ORD-2297. June 57, 21p.
Order from LC mi$2.70, ph$4.80 PB 136 204

A non-statistical and non-mathematical discussion of interest to statisticians, on the philosophy of statistics and statistical reasoning.

Washington Square Coll., New York U., N. Y.
ALGEBRAIC ASPECTS IN THE THEORY OF SYSTEMS OF LINEAR DIFFERENTIAL EQUATIONS, by Wilhelm Magnus. Rept. on Contract AF 18(600)367. June 53, 36p. 14 refs. Research rept. no. BR-3; AD-14 714.
Order from LC mi$3.00, ph$6.30 PB 136 717

The connection between the Baker-Hausdorff formula and systems of linear differential equations is discussed. On the algebraic side, a proof for a theorem by K. O. Friedrichs is given which characterizes Lie-elements in a free non-commutative ring. On the analytic side, criteria for the existence of solutions of systems of linear differential equations in terms of a finite number of quadratures are derived. The range of validity for the representation of the solutions in the form of an exponential function of a matrix is discussed. The case corresponding to a second-order differential equation is studied in detail.

Washington U., St. Louis, Mo.
MAXIMAL PROBLEM IN HARMONIC ANALYSIS, II, by I. I. Hirschman, Jr. Rept. on Contract AF 18(600)568. [1958] 24p. 3 refs. AFOSR TN-58-432 AD-158 236.
Order from LC mi$2.70, ph$4.80 PB 136 249

Washington U., St. Louis, Mo.
ON A LEMMA OF U. V. LINNIK, by A. Devinatz. Rept. on Contracts AF 49(638)218 and AF 18(600)568. 17 July 58, 4p. 1 ref. AFOSR TN-58-552; AD-158 370.
Order from LC mi$1.80, ph$1.80 PB 136 248

The following results were established: If f(x) and g(x) are continuous positive definite functions, g(x) is infinitely differentiable, the Hamburger moment sequence $\{(-i)^n g^{(n)}(0)\}_0^\infty$ is determined, and the origin is a limit point of zeroes of f(x) - g(x), then $f(x) \equiv g(x)$ on the whole axis.

[Wisconsin U., Madison]
FOURIER TRANSFORMS, CONFORMAL MAPPING, ENTIRE FUNCTIONS, AND ASYMPTOTIC SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS, by A. C. Schaeffer and J. Korevaar. Rept. for 1 Sep 56-31 Aug 57 on Contract N7onr-285(07). Oct 57, 4p.
Order from LC mi$1.80, ph$1.80 PB 136 398

Computing Devices

Columbia U. School of Engineering, New York.
DESIGN OF ANALOG COMPUTER COMPENSATED CONTROL SYSTEMS, by Stephen C. Bigelow. Technical rept. T-27B on Contract AF 18(600)677. 15 Feb 58, 31p. 11 refs. CU-42-58-AF-677-EE; AFOSR TN-58-316; AD-154 220.
Order from LC mi$3.00, ph$6.30 PB 136 262

This paper presents a method of solving the above problem for a particular class of control systems, which parallels that developed for the design of sampled data control systems. The restrictions on the specifications of the overall system imposed by the characteristics of the plant are stated explicitly.

Columbia U. School of Engineering, New York.
LINEAR MODULAR SEQUENTIAL CIRCUITS, by Bernard Friedland. Technical rept. T-29/B on Contract AF 18(600)677. 15 Apr 58, 23p. 8 refs. CU-45-58-AF-677-EE; AFOSR TN-58-555; AD-158 373
Order from LC mi$2.70, ph$4.80 PB 136 390

Sequential circuits comprising (i) modulo p (p:prime) summers, (ii) amplifiers whose gains are integers $< p$ and (iii) unit delays are considered in this paper which constitutes an extension of earlier work by D. Huffman. Such circuits are characterized in terms of the modular field GF(p) and vectors and matrices defined thereover. A summary of the properties of GF(p) is given.

Instrumentation Lab., Mass. Inst. of Tech., Cambridge.
DESIGN AND INSTRUMENTATION OF A COMPLEX PLANE ANALYZER, by Albert D. Ehrenfried. Master's thesis. Rept. on Contract W33-038-ac-13969. Jan 53, 103p. 16 refs. Rept. T-27; AD-14 658.
Order from LC mi$5.70, ph$16.80 PB 135 928

The Complex Plane Analyzer is a portable instrument for the rapid and accurate multiplication of vectors on the complex frequency (s or p) plane. Vectors of the forms s, (s + a) and (s + a ± jw) are composed on the s-plane and multiplied together electrically. The

magnitudes and phase angles of performance functions, residues, sinusoidal and step responses are read directly on a meter. Root Loci are found by seeking points which satisfy the 180° angle condition. An additional metering mode permits magnitude, angle and damping ratio measurements to be made directly on the s-plane.

Massachusetts Inst. of Tech., Cambridge.
ELECTRONIC DIGITAL MACHINES FOR HIGH-SPEED INFORMATION SEARCHING, by Philip Rutherford Bagley. Master's thesis, 24 Aug 51. 143p. 57 refs. ATI-201 922.
Order from LC mi$7.20, ph$22.80 PB 135 440

The object of this thesis is to examine methods and machines designed to make possible the high-speed location of related items in a large body of suitably-indexed information. It has been conclusively shown here that without major modifications an electronic digital computer designed for general mathematical work is inherently unsuited to the information searching process. It is possible, however, to construct an electronic machine from standard digital computer components (flip-flops, gates, etc.) which would be capable of scanning the index to nearly 5 million documents per hour (at 900 binary digits per document) and of preparing a list of the serial numbers of the selected documents. Metal magnetic tape seems to be the most suitable storage medium for the index.

Naval Ordnance Lab., Corona, Calif.
DART PROJECT, by L. P. Meissner and E. O. Codier. Final rept. Aug 54, 55p. 4 refs. NOL-CORONA Rept. 172.
Order from LC mi$3.60, ph$9.30 PB 137 658

No previous system is known to have been built that incorporated the basic concept of the DART (Differential Analyzer, Real Time) system design. Preliminary analysis has indicated that it would be unreasonable to explore the problems involved in this design, at least to the point of determining the feasibility of building large-scale computing systems based on this concept. In view of the great potential importance of such a computer, it is felt that exploration of this problem will yield valuable results.

Parsons Corp., Traverse City, Mich.
A SYSTEM FOR AUTOMATIC PROCESSING OF FATIGUE DATA, by A. J. Belfour and W. S. Hyler (Battelle Memorial Inst. Contract AF 33(616)3300) Rept. for 1 Jan 56 - 31 Mar 57 on Aircraft Propeller Technology and Materials Analysis and Evaluation Techniques, Contract AF 33(616)3301. Jan 59, 195p. 58 refs. WADC Technical rept. 58-461; AD-207 792.
Order from OTS $3.00 PB 151 596

This report presents and discusses a system for coding of fatigue information on IBM cards for subsequent automatic processing of the data. Certain codes are needed for some types of entries; the design and preliminary development of these codes are included. The card system devised will permit coding not only the basic fatigue information (stress and lifetime) but also pertinent information describing: (1) the basic material and fabrication, (2) mechanical properties of the material, (3) specimen design and methods of preparation, and (4) type of test and associated testing procedure. The system is useful in coding information from basic fatigue studies of materials as well as component and structural fatigue studies.

MECHANICS

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
MAGNETOHYDRODYNAMICS AND MAGNETOGASDYNAMICS, by S. I. Pai. Rept. on Contract AF 18(600)993. Sep 55, 36p. 23 refs. Technical note BN-59; OSR TN-55-347; AD-74 432.
Order from LC mi$3.00, ph$6.30 PB 138 263

The fundamental equations of magnetofluiddynamics are derived. For incompressible fluid, magnetohydrodynamics, the important parameters are the Reynolds number R_e, the magnetic pressure number R_H, which is the ratio of magnetic pressure to dynamic pressure, and the velocity number R_v, which is the ratio of the fluid velocity to the characteristic velocity of which the magnetic field is moving through a conductor.

Institute of Flight Structures, Columbia U., New York.
DOMINANCE OF SHEAR STRESSES IN EARLY STAGES OF IMPULSIVE MOTION OF BEAMS, by H. H. Bleich and R. Shaw. Technical rept. no. 20 on Contract Nonr-266(08). Oct 57, 19p. 3 refs. CU-20-7-ONR-266(08)-CE.
Order from LC mi$2.40, ph$3.30 PB 137 714

It is the purpose of the present paper to show that all beams, even those which are statically much stronger in shear than in bending will begin to yield in shear before yielding in bending, if subjected to sufficiently high initial velocity distributions. This conclusion is drawn from an elastic approach allowing for shear and rotary inertia effects, based on the well known differential equations for the Timoshenko Beam. The yielding in shear found occurs a very short time after the initiation of the motion; it is an additional case of yielding in shear which does not occur in the rigid-plastic analysis.

Massachusetts Inst. of Tech., Cambridge.
MAGNETROSTRICTIVE DRIVE TECHNIQUES FOR FATIGUE TESTING OF METALS ABOVE 10 KILOCYCLES, by P. J. Brosens, R. W. Reid, and T. P. Rona. Rept. on Contract AF 33(616)3233, Continuation of Contract AF 33(616)378. Dec 57, 115p. 15 refs. WADC Technical rept. 57-438; AD-205 547.
Order from OTS $2.50 PB 151 565

An investigation program is described in which the purpose was to study high frequency metal fatigue applicable to turbine blades in the 12.8 Kcps frequency domain. Whereas originally the work was directed toward fatigue characteristics and mode determination,

it soon appeared more expedient to branch out in study of the detection and calibration methods; of the analytical and experimental approach of the impedance match problem between source and load; of the evaluation of other methods of excitation and in the use of the existing equipment to trace fatigue development by frequency and damping measurements. In the above areas, a light modulation technique has been developed successfully for the determination of vibration amplitude. A magnetrostrictive impedance probe has been designed, constructed, and tested but is has not been found of considerable usefulness in the excitation of small specimens. A number of fatigue failures have been obtained in selected specimens at 12.8 Kcps and changes in oscillatory characteristics did in each case precede failure; the experimental program has been judged insufficient to warrant specific conclusions but certainly adequate to recommend further work in the field.

Aerodynamics and Pneumatics

Advisory Group for Aeronautical Research and Development, Paris (France)
DISCUSSIONS FOLLOWING THE PRESENTATION OF PAPERS ON HYPERSONICS [PRESENTED AT THE] 11th MEETING OF THE WIND TUNNEL AND MODEL TESTING PANEL, SCHEVENINGEN, THE NETHERLANDS, 8th - 12th JULY 1957. July 57, 46p.
Order from NASA AGARD 132-147

Advisory Group for Aeronautical Research and Development, Paris (France)
EXPLORATORY STUDIES OF HYPERSONIC FLUID MECHANICS, by Seymour M. Bogdonoff. July 57, 35p. 22 refs.
Order from NASA AGARD-142

Presented at the Eleventh Meeting of the Wind Tunnel and Model Testing Panel, held from 8th to 12th July, 1957, in Scheveningen, Holland.

Using a helium hypersonic wind tunnel, exploratory studies have been made of the flow over simple two- and three-dimensional bodies at Mach numbers from 11 to 19. Detailed studies of the flow over a flat plate are reviewed and preliminary results are presented for other configurations, including flat plates with flaps, delta wings, base pressure models, blunt models (with and without spikes) and slim cones. Some preliminary results of boundary layer studies and dissolving models are also discussed. In the particular area of hypersonic fluid mechanics, the helium tunnel has proved to be an extremely valuable tool. Its simplicity and ease of operation have permitted a very wide range of studies to be carried out with relatively small effort. It has provided information on flow phenomena in a Mach number range not heretofore subject to detailed investigation.

Advisory Group for Aeronautical Research and Development, Paris (France)
HYPERSONIC FLOW ABOUT A THIN BODY OF REVOLUTION, by R. Timman, July 57, 14p.
Order from NASA AGARD-141

Presented at the Eleventh Meeting of the Wind Tunnel and Model Testing Panel, held from 8th to 12th July, 1957, in Scheveningen, Holland.

In this paper the boundary layer equations are derived for a thin body of revolution in hypersonic flow, taking into account the curvature of the body. A 'similar' solution is found and the application of a Pohlhausen method with a suitable simple velocity profile gives the effect of radius of curvature in general terms. Further research is in progress.

Allied Research Associates, Inc., Boston, Mass.
THE INTERACTION OF MOVING SHOCK WAVES WITH APPLICATION TO AIRCRAFT BLAST LOADING, by Eugene L. Krasnoff. Rept. on Contract AF 33(616)5001. Sep 57, 37p. 10 refs. WADC Technical note 57-173; AD-131 013.
Order from LC mi$3.00, ph$6.30 PB 137 373

An expedient method of using plane shock tables or graphs to solve the problem of non-stationary interaction of plane shock waves is presented. Limitations of the method are discussed and several illustrative examples are included. The procedure is then applied to show the effect of the angle between two incident shock waves on the flow parameters in the region behind the transmitted shock waves. The relation between the blast loading of supersonic aircraft and the occurrence of two intersecting shock waves is pointed out. In addition, the effects of shock interaction on the gust loading of a flat-plate wing are discussed quantitatively. It is shown that shock interaction effects can exert an important influence on the vulnerability of supersonic aircraft to nuclear detonations.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
GRAPHS FOR USE IN OBTAINING DESIRED MACH AND REYNOLDS NUMBERS IN A SHOCK TUBE, by Robert J. Janus. Mar 58, 28p. 3 refs. Memo. rept. no. 1132.
Order from LC mi$2.70, ph$4.80 PB 136 423

Drag loading is a function of several flow parameters, of which two of the most important are Mach number and Reynolds number. This report presents graphs of Mach number and Reynolds number as functions of shock strength, and the change in Reynolds number as a function of temperature and shock strength. The use of the graphs is explained and examples are provided.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
LAMINAR INCOMPRESSIBLE BOUNDARY LAYER FLOW OVER THE CYLINDRICAL PORTION OF SLENDER BODIES OF REVOLUTION AT SMALL ANGLES OF ATTACK, by John C. Martin and Nathan

Gerber. Nov 57, 54p. 11 refs. Rept. no. 1038.
Order from LC mi$3.60, ph$9.30 PB 135 337

As an approximation to the boundary layer on a certain class of bodies of revolution a solution is obtained of the three-dimensional boundary layer equations on an open end cylinder at small angles of attack. The solution is in the form of a power series expansion in the angle of attack. The series is obtained up to and including the third order in angle of attack.

Brown U. Div. of Applied Mathematics, Providence, R. I.
LIMIT ANALYSIS OF SYMMETRICALLY LOADED THIN SHELLS OF REVOLUTION, by D. C. Drucker and R. T. Shield. Technical rept. no. 25 on Contract Nonr-562(10). Aug 57, 35p. 9 refs. Rept. no. C11-25.
Order from LC mi$3.00, ph$6.30 PB 137 022

The yield surface for a thin cylindrical shell is shown to be a very good approximation to the yield surface for any symmetrically loaded thin shell of revolution. Hexagonal prism approximations to this yield surface, appropriate for pressure vessel analysis, are described and discussed in terms of limit analysis. Procedures suitable for finding upper and lower bounds on the limit pressure for the complete vessel are developed and evaluated.

Cessna Aircraft Co., Wichita, Kans.
BOUNDARY LAYER CONTROL APPLIED TO TAIL SURFACES OF AIRCRAFT. PART I. WIND TUNNEL REPORT, by L. L. Leisher and W. M. Gertsen. Rept. on Contract AF 33(616)3463. Dec 57, 159p. 5 refs. WADC Technical rept. 57-741, pt. 1; AD-142 216.
Order from LC mi$7.50, ph$24.30 PB 137 925

Wind tunnel tests of a model of a horizontal tail surface equipped with low pressure high lift boundary layer control were made to determine lift, drag, pitching moment, hinge moment coefficients, and chordwise pressure distributions for various angles of attack, elevator deflections, and blowing quantity flow coefficients. The reflection-plane model had an aspect ratio of 2.83 and an airfoil section thickness varying from .09c at the root to .06c at the tip. Air was ejected through a slot located slightly forward of the elevator hinge line. Results obtained were: elevator effectiveness ($d\alpha/d\delta$), .876, and maximum tail lift coefficient, -1.72. These results were obtained at a blowing quantity flow coefficient of .0189 and an effective Reynolds Number of 1.84×10^6. Tests were made by the Research Department of the Cessna Aircraft Company utilizing the 7 x 10 ft. wind tunnel of the University of Wichita.

Cessna Aircraft Co., Wichita, Kans.
BOUNDARY LAYER CONTROL APPLIED TO TAIL SURFACES OF AIRCRAFT. PART II. FINAL REPORT, by W. M. Gertsen, and W. D. Wise. Final rept. on Contract AF 33(616)3463. Dec 57, 170p. 8 refs. WADC Technical rept. 57-741, pt. 2; AD-142 221.
Order from LC mi$7.80, ph$25.80 PB 137 924

The results of flight tests to determine the effects of blowing boundary layer control applied to the tail surfaces of the Cessna Model 319B are presented. This airplane was equipped with an improved Arado type wing BLC system. The design, construction, structural test and installation of BLC tail surfaces are described, as well as the flight test results. The use of BLC tail surfaces was found to be very beneficial for improving longitudinal control, the data indicating improvement equivalent to an increase of 52 per cent in tail volume coefficient. The effects of the tail BLC upon longitudinal stability and upon directional stability and control were generally favorable although relatively small.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MODEL INSTRUMENTATION TECHNIQUES FOR HEAT TRANSFER AND FORCE MEASUREMENTS IN A HYPERSONIC SHOCK TUNNEL, by R. J. Vidal. Rept. on Contract AF 33(616)2387. Feb 56, 79p. 22 refs. Rept. no. AD-917-A-1; WADC TN-56-315; AD-97 238.
Order from LC mi$4.50, ph$12.30 PB 138 852

Analytical and experimental research devoted to devising and developing instrumentation for making heat transfer and force measurements in a shock tunnel is reported. Performance of a thin metal resistance thermometer mounted on an insulating body is analyzed and methods are given for constructing this instrument. Experimental results are described which were obtained in subsonic flow generated in a shock tube. These results demonstrate the feasibility and reliability of this heat transfer instrument. An accelerometer balance system, designed and constructed for taking force measurements, is described and its performance analyzed.

David Taylor Model Basin, Washington, D. C.
FRICTIONAL RESISTANCE AND TURBULENT BOUNDARY LAYER OF ROUGH SURFACES, by Paul S. Granville. June 58, 51p. 26 refs. Rept. 1024.
Order from LC mi$3.60, ph$9.30 PB 135 330

By means of the similarity laws of the turbulent flow in boundary layers, a general relation is developed for the frictional resistance of flat plates with arbitrary roughness from which logarithmic formulas are obtained for the special cases of the fully rough regime, the quasi-smooth regime, and engineering roughness. Among other uses, this general relation permits for the first time a simple rational extrapolation to full-scale conditions of the frictional resistance of model plates covered uniformly with any irregular full-scale roughness encountered in practice.

David Taylor Model Basin, Washington, D. C.
NEW METHOD FOR OBTAINING TURBULENT-BOUNDARY-LAYER PROFILES, by R. T. Patterson. Dec 55, 10p. Aero rept. 889.
Order from LC mi$1.80, ph$1.80 PB 135 327

This method allows turbulent-boundary-layer total and displacement thicknesses to be determined more accurately and more easily than the method formerly employed.

Gas Turbine Lab., Mass. Inst. of Tech., Cambridge.
SHEAR FLOW IN BENDS, by Hans P. Eichenberger. Technical rept. no. 2 Jan 51-Jan 52 on Contract N5ori-078(48). 15 Apr 52, 61p. 24 refs. ATI-151 185.
Order from LC mi$3.90, ph$10.80 PB 139 028

The reported work has been performed in the Gas Turbine Laboratory at M. I. T. in the period January 1951 to January 1952. In the theory of axial flow compressor design one usually assumes the existence of potential flow. In reality the stagnation pressure varies from streamline to streamline even after a few stages. The resulting flow deviates, therefore, from the potential flow and the difference between this flow and the potential flow is called secondary flow. This flow is investigated analytically and experimentally in this report. The experiments were performed in 90° bend with 8" x 8" cross section. Water was used to obtain Reynolds numbers from 7000 to 90,000; higher Reynolds numbers (370,000 to 720,000) were investigated using air in the same bend. Measurements of the velocity head and the direction of flow were made at different bend angles, usually at 126 points in each cross section. Injected oil droplets of the same density as water allowed visual observation when water was used.

Heat Transfer Lab., U. of Minnesota, Minneapolis.
MASS TRANSFER COOLING OF A LAMINAR BOUNDARY LAYER BY INJECTION OF A LIGHT-WEIGHT FOREIGN GAS, by E. R. G. Eckert, P. J. Schneider and others. Technical note no. 14 on Contract AF 18(600)1226. June 57, 49p. 8 refs. AFOSR TN-57-323; AD-132 395.
Order from LC mi$3.30, ph$7.80 PB 136 222

Analytical predictions are given for the development of the velocity, temperature, and concentration fields in a laminar air boundary layer on a flat plate in high-speed dissipative flow, the plate being considered porous and cooled by injection of hydrogen from its surface. The admixture of hydrogen, having a low density and high thermal capacity relative to air, is shown to greatly diminish the skin friction and to markedly relieve the adverse thermal effects of intense aerodynamic heating under conditions of hypersonic flow.

Michigan U., Ann Arbor.
LOW REYNOLDS NUMBER AERODYNAMICS OF FLAPPED AIRFOILS AT SUPERSONIC SPEEDS, by James L. Amick and Gerard F. Carvalho. Rept. on Contract AF 33(616)3573. Sep 58, 95p. 21 refs. WADC Technical rept. 58-466; AD-155 854.
Order from OTS $2.25 PB 151 597

This report presents theoretical and experimental characteristics of plain and flapped airfoils at Reynolds numbers low enough to allow pure laminar flow. The theoretical results are based on a semi-empirical equation for the pressure rise at laminar separation. Calculated aerodynamic characteristics of two-dimensional controls, including an all-movable wing, trailing flaps, and a leading flap, for control deflections up to 90°, at Mach number 6.0 and Reynolds number 300,000, show the all-movable wing to have the most desirable control characteristics. For the trailing flaps, the calculated lift coefficients at large flap deflections are greatly reduced by laminar separation, in some cases to less than half that which would be expected at Reynolds numbers high enough to give turbulent boundary layers. The lift calculated for the leading flap is less than for the other types of controls, for a given drag or moment. Force test results at Mach numbers 2.4 and 3.8, and schlieren pictures at Mach numbers 2.0 and 4.5 for airfoils with and without trailing flaps, at Reynolds numbers between 18,000 and 160,000, are in general agreement with the predicted trends. The test Reynolds numbers correspond to a five-foot chord wing flying at altitudes of 140,000 to 200,000 feet. The schlieren pictures include some cases of large flap deflection where an oscillating flow was observed.

Naval Ordnance Lab., White Oak, Md.
NOL STRAIN-GAGE BALANCED NETWORK, CALCULATION OF ERRORS DUE TO LEAD RESISTANCE, by W. A. Menzel. 1 Oct 57, 32p. 1 ref. NAVORD rept. 5683.
Order from LC mi$3.00, ph$6.30 PB 137 456

In determining the aerodynamic forces and moments in wind-tunnel tests from internal strain-gage balances it is essential to know the influence of the interconnecting cables between balance and instrumentation on the resulting data. This report outlines the effect of the lead resistance for the NOL internal strain-gage balance with common power leads on resulting raw data. A detailed calculation in the appendix shows how the strain-gage network is reduced to a normal bridge circuit.

Naval Air Development Center, Johnsville, Pa.
NONDIMENSIONAL CHARACTERISTICS OF FREE AND DEFLECTED SUPERSONIC JETS EXHAUSTING INTO QUIESCENT AIR, by Arthur R. Anderson and Frank R. Johns. 25 Mar 54, 140p. 16 refs. Rept. no. NADC ED-5401.
Order from LC mi$6.90, ph$21.30 PB 136 394

Pressure and temperature measurements were taken downstream of a supersonic, heated-air jet at exit Mach numbers of 1.40 and 1.84 for a free jet and of a deflected jet at angles of 10, 25, and 50 degrees, with the jets exhausting into quiescent air. At both Mach numbers, the jet was operated at an exit total temperature of 1500° F. To evaluate temperature effects, the jet at the exit Mach number of 1.40 was also operated at total temperatures of from 740° to 2200° F. Conclusions are drawn as to velocity, pressure, and temperature distribution downstream from the horizontal supersonic jet, and pressure and temperature distribution downstream of impingement from the deflected supersonic jet.

National Advisory Committee for Aeronautics, Washington, D. C.
A MACH 4 ROCKET-POWERED SUPERSONIC TUNNEL USING AMMONIA-OXYGEN AS WORKING FLUID, by Robert W. Graham, Eleanor Costilow Guentert, and Vearl N. Huff. Sep 58, 53p. 5 refs.
Order from NASA NACA TN-4325

To simulate the high heating rates encountered in hypersonic flow, the exhaust gases from an ammonia-

oxygen rocket have been used to power a supersonic tunnel. A gas temperature of 4500°R at Mach 4 was produced in the 15-inch test section of the tunnel. The calibration pressure data indicate reproducibility of test conditions in this facility. Physical, transport, and one-dimensional aerodynamic data for combustion products of ammonia and oxygen are included.

National Advisory Committee for Aeronautics, Washington, D. C.
INVESTIGATION OF THE DYNAMIC RESPONSE OF AIRPLANE WINGS TO GUSTS, by Harold B. Pierce. June 47, 83p. 16 refs.
Order from NASA NACA TN-1320

A method of predicting the dynamic response of airplane wings to gusts by considering only the fundamental mode of bending is presented, together with the results of model tests made to evaluate the method. In addition, the results of a series of calculations obtained by using the method are given to illustrate changes in the dynamic response of airplane wings brought about by changes in gust and airplane parameters. An appendix giving the details of the method and the procedure for the determination of constants is included.

Naval Supersonic Lab., Mass. Inst. of Tech., Cambridge.
STABILITY OF BINARY BOUNDARY LAYERS, by Eugene E. Covert. Technical rept. no. 217 on Contract AF 18(603)82. June 57, 32p. 8 refs. AFOSR TN-57-200; AD-126 497.
Order from LC mi$3.00, ph$6.30 PB 137 388

The steady properties of a binary-boundary layer, i.e., a boundary layer consisting of a mixture of two component gases, have indicated that there are practical advantages in cooling a surface by introducing a foreign gas into the boundary layer. However, since the calculations are based on laminar flow, it was deemed advisable to consider the stability of the binary laminar-boundary layer. The results indicate that for relatively small injection rates which ensure that the boundary-layer approximation is still valid, the stability can be calculated for the binary boundary layer (and, incidentally, an n-component boundary layer) in the usual way, based upon the steady-state velocity and density profiles without additional complications due to added equations.

Pastushin Aviation Corp., Los Angeles, Calif.
BALANCE SYSTEM FOR MEASURING IN-FLIGHT AIR LOADS ON EXTERNAL STORES, by H. Benton Ehrlich. Rept. for June 54-June 56 on Flight Investigation of Aerodynamic Forces on External Stores, Contract AF 33(600)27672. July 57, 104p. 8 refs. WADC Technical rept. 57-101; AD-131 076.
Order from LC mi$5.70, ph$16.80 PB 137 769

A six component balance system for measuring total in-flight loads and determining air loads on external stores was designed, developed, calibrated and flight tested. The balance, designed for loads in excess of F-86F aircraft loads, was installed in a 200-gallon standard Air Force tank and flight tested at the Wright Air Development Center on an F-86H aircraft for the purpose of establishing the suitability of the system. Details of the design and calibration are given herein in addition to the method of reduction of flight test data and a sample calculation for one flight condition. The data obtained during the flight test program are presented as aerodynamic coefficients. The six component balance system has been qualified as a satisfactory means of obtaining the actual flight loads on the store in which it is contained.

Polytechnic Inst. of Brooklyn, N. Y.
HIGH TEMPERATURE-PRESSURE AIR HEATER (SUITABLE FOR INTERMITTENT HYPERSONIC WIND-TUNNEL OPERATION) by Martin H. Bloom. Rept. on Wind Tunnel Studies, Contract AF 33(616)17. Nov 56, 36p. 40 refs. WADC technical note 55-694; AD-110 725.
Order from LC mi$3.00, ph$6.30 PB 137 159

An account is given of the design, construction and operation of a new type of convection heater suitable for supplying pure air intermittently. With the model constructed, temperatures up to 3000°R and pressure up to 600 psia can be achieved with flow rates on the order of 10 lb/sec and run durations on the order of 1 minute. A heat-storage bed of ceramic pebbles, heated by ceramic electrical resistance elements, is used. A unit has been in operation at the PIBAL hypersonic facility since December 1954.

Polytechnic Inst. of Brooklyn, N. Y.
INCOMPRESSIBLE MIXING OF A SHEAR FLOW WITH FLUID AT REST, by Luigi G. Napolitano. Rept. on Contract AF 18(600)693. Nov 57, 47p. 16 refs. PIBAL rept. no. 318; AFOSR TN-57-754; AD-136 743.
Order from LC mi$3.30, ph$7.80 PB 137 449

The laminar and turbulent mixing of a non-uniform free stream with fluid at rest is investigated. Laminar and turbulent vorticity numbers are defined, which measure the relative importance of the free stream vorticity as compared to the average vorticity present in the wake. Solutions of the subject problem are given to a first approximation in the vorticity numbers.

Technische Hochschule, Aachen (Germany).
MEASUREMENTS OF THE BOUNDARY LAYER THICKNESS AND RELAXATION OF IONIZATION BEHIND STRONG SHOCK WAVES WITH A NEW CAPACITIVE PROBE, by H. Groenig and H. D. Weymann. Technical note no. 1 on Contract AF 61(514)1046. [Feb 58] 28p. 9 refs. AFOSR TN-58-387; AD-154 294.
Order from LC mi$2.70, ph$4.80 PB 136 256

This report deals with the measurements of the thickness of the boundary layer with a capacity probe. This probe flush inserted into the wall of the shock tube and thus avoiding any disturbances in the flow is sensitive to the thickness of the boundary layer, when the gas in the undisturbed flow is ionized. The experimental results for argon at Mach numbers between 5 and 10 show the usefulness of the probe for measuring the thickness of the boundary layer, the relaxation time of ionization

and the coefficient of diffusion. The experiments were carried out in argon because high Mach numbers could be achieved in argon even with a small shock tube.

Rensselaer Polytechnic Inst., Troy, N. Y.
ON A BOUNDARY LAYER APPROXIMATION TECHNIQUE, by K. T. Yen. Rept. on Contract AF 49(638)23. 1 Apr 58, 28p. 10 refs. TR AE5802; AFOSR TN-58-403; AD-158 206.
Order from LC mi$2.70, ph$4.80 PB 136 251

The problem of two-dimensional steady viscous flow is formulated using the streamlines and their orthogonal trajectories as generalized coordinates. Based on this, two boundary layer approximations are then developed. The first one, called the P-approximation, applies to boundaries with surface curvature equal to zero. This approximation is essentially equivalent to Prandtl's boundary layer theory. The second boundary layer approximation, called the C-approximation, is developed for the study of the effect of surface curvature. The conditions under which similar solutions exist for the C-approximations are obtained. Because of the complexity of the differential equations, high speed computing machines will have to be used to obtain solutions of the C-approximation.

Stanford U., Calif.
ON THE NATURE OF STALL, by Stephen J. Kline. Rept. MD-4 on Contracts AF 49(638)201 and AF 49(638)295. June 58, 77p. 33 refs. AFOSR TN-58-637; AD-162 168.
Order from LC mi$4.50, ph$12.30 PB 136 393

The physical data available on the problem of stall are reviewed. The discussion is centered on the problem of flow in passages, but a few comparisons with external flow are given. The emphasis is placed on systematic visual data showing flow patterns as a function of geometrical parameters. These data lead to a view of stall as a spectrum including three or possibly four major types of flow patterns; these patterns involve both transient and steady elements.

Stanford U., Calif.
OPTIMUM DESIGN OF STRAIGHT-WALLED DIFFUSERS, by S. J. Kline, D. E. Abbott, and R. W Fox. Rept. PD-4 on Contracts AF 49(638)201 and AF 49(638)295. June 58, 33p. 37 refs. AFOSR TN-58-638; AD-162 169.
Order from LC mi$3.00, ph$6.30 PB 136 392

The four common optimum problems in diffuser design are defined. These optima are located in relation to the overall flow regimes in terms of geometrical parameters for straight-walled units. Using an empirically derived transformation of variables between the conical and two-demensional geometries, all available data for optimum recovery at constant ration of wall length to throat width are correlated by a single straight line. This line lies slightly above and parallel to the line of onset of large transitory stall on the chart of overall flow regimes. The correlated results are based on a literature survey. The range of conditions for each investigation is tabulated for convenient future reference.

Stanford U. Div. of Engineering Mechanics, Calif.
THERMAL STRESSES IN CYLINDRICAL SHELLS, by R. A. Eisentraut. Technical rept no. 112 on Contract Nonr-225(16). 30 Oct 57, 82p. 13 refs.
Order from LC mi$4.80, ph$13.80 PB 136 282

Texas A. and M. Research Foundation, College Station.
THEORY AND ANALYSIS OF CLEAR-AIR TURBULENCE, by Yoshikazu Sasaki. Scientific rept. no. 1 on Contract AF 19(604)1565. May 58, 82p. 26 refs. AFCRC TN-58-487.
Order from LC mi$4.80, ph$13.80 PB 137 177

A convenient stability diagram is used for the analysis of clear-air turbulence in the region of the jet stream. Application of this stability diagram analysis to the data from four B-47 Project Jet Stream flights shows a rather systematic distribution of clear-air turbulence and also important effects of the tropopause and other similar discontinuities on clear-air turbulence. Theoretical explanations for the distribution of clear-air turbulence in the diagram are tested considering simplified models of stratification of the atmosphere near the tropopause and jet stream. New stability criteria are obtained by the theoretical treatment and applied to the observed data. The results are given showing comparison between the computed unstable region and the observed distribution of clear-air turbulence.

Hydrodynamics, Hydraulics, and Hydrostatics

Applied Mathematics and Statistics Lab., Stanford U., Calif.
FLOWS WITH FREE BOUNDARIES IN A TUBE, by Eugene R. Rodemich. Technical rept. no. 67 on Contract Nonr-225(11). 8 Aug 57, 64p. 28 refs.
Order from LC mi$3.90, ph$10.80 PB 136 275

Brown U. Div. of Applied Mathematics, Providence, R. I.
STEADY FLOW OF NON-NEWTONIAN FLUIDS THROUGH TUBES, by A. E. Green and R. S. Rivlin. Technical rept. no. 2, Sep-Oct 55, on Application of Invariance Principles in Continuum Mechanics, Contract DA 19-020-ORD-3487. Oct 55, 19p. 4 refs. DA-3487/2.
Order from LC mi$2.40, ph$3.30 PB 138 633

Ericksen has shown that in general, for non-Newtonian fluids, the equations of motion for rectilinear flow through a tube of non-circular cross-section are incompatible. In the present paper, this is further discussed and it is shown that, for a particular type of non-Newtonian fluid, a solution exists for the problem of flow through a tube of elliptical cross-section in which four vortex-like motions in the cross-sectional plane of the tube are superposed on the rectilinear flow along the tube.

California Inst. of Tech., Pasadena.
A LINEARIZED THEORY FOR NONSTEADY CAVITY FLOWS, by T. Yao-tsu Wu. Rept. on Contract Nonr-220(28). Sep 57, 35p. 11 refs. Engineering Div. rept. no. 85-6.
Order from LC mi$3.00, ph$6.30 PB 136 440

In this investigation the linear theory with the use of the acceleration potential is first reviewed and then applied to formulate the problem of the unsteady flow past a fully cavitated slender body with an arbitrary profile. The general expression for the lift, drag, moment and the cavity cross-section area are then derived

California Inst. of Tech., Pasadena.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF A SUBCAVITATING HYDROFOIL, by R. L. Wald and Z. M. Lindberg. Rept. on Contract Nonr-220(12). Apr 57, 71p. 6 refs. Engineering Div. rept. no. 47-8; AD-139 257.
Order from LC mi$4.50, ph$12.30 PB 139 030

An experimental investigation of the two-dimensional hydrodynamic characteristics of a thin, supercavitating hydrofoil is described. The effects of twist and vibration of the thin hydrofoil model are considered, and experimental techniques for investigating spanwise twist and leading edge vibration and data correction methods are described. The theory of Wu for the forces on fully cavitating hydrofoils was used to calculate the forces on this profile. The calculated lift is in good agreement with the experimental results; however, the measured drag differs appreciably from the theoretical values.

California Inst. of Tech., Pasadena.
ON THE THEORY OF SURFACE WAVES IN WATER GENERATED BY MOVING DISTURBANCES, by C. R. De Prima and T. Y. Wu. Rept. on Contract N6onr-244(20). May 57, 41p. 17 refs. Rept no. 21-23.
Order from LC mi$3.30, ph$7.80 PB 136 124

The purpose of this paper is to try to understand the physical mechanism underlying the steady configuration of the surface wave phenomena and to clarify to a certain extent the background of the artifices adopted for solution of steady-state problems. The point of view to be presented here is that this problem should be formulated first as an initial value problem (for example, the body starts to move with constant velocity at a certain time instant), and then the stationary state is sought by passing to the limit as the time tends to infinity.

California Inst. of Tech., Pasadena.
SIMPLE METHOD FOR CALCULATING THE DRAG IN THE LINEAR THEORY OF CAVITY FLOWS, by T. Yao-tsu Wu. Rept. on Contract Nonr-220(28). Aug 57, 24p. 12 refs. Engineering Div. rept. no. 85-5.
Order from LC mi$2.70, ph$4.80 PB 135 868

Recently Tulin has introduced the idea of linearization to treat two classes of two-dimensional cavity flows: the pure drag problem and the lifting problem. A simple method of calculating the drag is presented here, which merely amounts to an expansion of the complex velocity near the rear end of the cavity, the drag being then proportional to the square of the first coefficient of the expansion. Owing to the different singular behavior of the problem in the fully cavitated and partially cavitated case, this method is discussed separately for these two cases.

David Taylor Model Basin, Washington, D. C.
FEASIBILITY STUDY OF METHODS FOR SIMULATING BY STATIC FORCES THE NONUNIFORM HYDRODYNAMIC PRESSURES ON SONAR DOMES, by Myron E. Lunchick, Joseph H. Eibling, and Robert D. Short, Jr. May 57, 21p. Rept. 1134.
Order from LC mi$2.70, ph$4.80 PB 136 101

The use of rubber pressure cells to simulate hydrodynamic loads statically is discussed. Tests on a flat plate to ascertain the validity of the method are described. Although the method is feasible for testing flat plates, it is anticipated that a complex shape like a sonar dome would involve a much more extensive test procedure.

Grumman Aircraft Engineering Corp. [Bethpage, N. Y.]
STUDY OF HYDROFOIL SEACRAFT. Study summary on Contract MA-1730. Nov 58 [13]p. PGB-H-1.
Order from OTS $0.50 PB 151 475

Institute of Engineering Research, U. of California, Berkeley.
LINEARIZED THEORY OF THE INTERACTION OF SHIPS, by Bennett Lyons Silverstein. Technical rept. no. 3 on Hydrodynamics of Naval Architecture, Contract Nonr-222(30). 15 May 57, 81p. 18 refs. Series 82, Issue 3.
Order from LC mi$4.80, ph$13.80 PB 136 121

This dissertation will be concerned only with the lateral force and the yawing moment due to the interaction of two ships traveling parallel paths at the same speed in any relative positions. For the case of two ships passing (in the same direction), if the relative speed is low, the forces and moments may be considered as due to the instantaneous relative positions. There is a scarcity of data on yawing moment and attraction force, though considerable effort has been devoted to interaction effects on resistance.

Naval Civil Engineering Research and Evaluation Lab., Port Hueneme, Calif.
FORCES INDUCED BY WAVES ON THE MOORED U. S. S. NORTON SOUND (A. V. M. -1) by J. T. O'Brien and D. I. Kuchenreuther. Interim rept. 30 Apr 58, 57p. 13 refs. Technical memo. M-129.
Order from LC mi$3.60, ph$9.30 PB 136 384

Object: to collect and correlate data concerning the forces imposed upon waterfront and offshore structures and moorings; to obtain, in order to improve the design of moorings, factual data of the forces im-

posed on ship moorings through action of waves on the moored vessel; to present measurements made by NAVCERELAB of the forces induced by standing waves in the lines of the U. S. S. NORTON SOUND (A. V. M. -1) when moored alongside in Port Hueneme, California, the methods used to calculate these forces, and comparisons between measured and calculated values.

Wave Research Lab., U. of California, Berkeley.
MODEL STUDY OF A HYDRAULIC BREAKWATER OVER A SUBMERGED BARRIER, by C. M. Snyder. Master's thesis. Technical rept. on Contract Nonr-222(46). Nov 57, 61p. 7 refs. Series 104, Issue 3.
Order from LC mi$3.90, ph$10.80 PB 136 396

The experimental results of tests on a combination model of a hydraulic breakwater and submerged breakwater (reef type) are described. The sizes of the reefs were varied, using five widths and five heights for each width. The wave height attenuation was measured for various discharge rates of the jets over each of the reefs. A fixed wave length and water depth was used with a ratio of wave length to water depth of 6.16. Graphs are presented, which show the relationship between wave height attenuation and jet flow rate, and which also show the wave height attenuation and jet discharge power of the jets.

Wave Research Lab., U. of California, Berkeley.
SHIPBOARD HYDRAULIC BREAKWATER, by R. A. Dilley. Master's thesis. Technical rept. on Contract Nonr-222(46). Aug 57, 56p. 7 refs. Series 104, Issue 2.
Order from LC mi$3.60, ph$9.30 PB 136 119

A model hydraulic breakwater was constructed on a 1:86.5 scale model Liberty Ship. The ship was moored in a model basin in seven inches of water and subjected to a series of different wave conditions. The mooring forces and wave attenuation were measured. Graphs showing the relationship between wave attenuation and jet-flow rate and the dependence of mooring force on wave height are included.

Wave Research Lab., U. of California, Berkeley.
SOLITARY WAVE REFLECTION ALONG A STRAIGHT VERTICAL WALL AT OBLIQUE INCIDENCE, by Paul Henri Perroud. Doctoral thesis. Technical rept. on Contracts Nonr-222(42) and Nonr-233(35). Sep 57, 101p. 20 refs. Series 99, Issue 3.
Order from LC mi$5.70, ph$16.80 PB 136 120

In shallow water the general analytical problem of the oblique reflection of waves of finite amplitude encounters considerable difficulty. The solitary wave has been used as representative of waves of finite height in order to perform some experimental and theoretical studies.

Statics, Kinematics, and Kinetics

Brown U., Providence, R. I.
PHOTOELASTIC INVESTIGATION OF THE STRESS DISTRIBUTION IN A CONE WITH A BAND OF PRESSURE AT THE VERTEX, by W. B. Woodward. Rept. on Contracts DA 19-020-ORD-2598 and DA 19-020-501-ORD-3984. Oct 57, 42p. 10 refs. DA-2598/3984/21; WAL 143/20-47.
Order from LC mi$3.30, ph$7.80 PB 137 125

David Taylor Model Basin, Washington, D. C.
DETERMINATION OF INFLUENCE COEFFICIENTS AS APPLIED TO CALCULATION OF CRITICAL WHIRLING SPEEDS OF PROPELLER-SHAFT SYSTEMS, by B. M. Wigle and N. H. Jasper. May 57, 17p. 4 refs. Rept. 1050.
Order from LC mi$2.40, ph$3.30 PB 136 102

Formulas developed at the David Taylor Model Basin for computing the critical frequencies of whirling vibration of propeller shafting systems require the determination of influence coefficients in their application. This report describes methods for determining the necessary influence coefficients for use with these formulas and tabulates, for purposes of comparison, computed and experimentally determined natural frequencies.

METALLURGY

Ford Motor Co., Dearborn, Mich.
IRON-ALUMINUM ALLOY SYSTEMS, PART I. FUNDAMENTAL STUDIES AND ALLOY DEVELOPMENT, by P. X. Kayser. Rept. for Apr 56-Mar 57 on Metallic Materials, Contract AF 33(600)32448. May 57, 35p. 24 refs. WADC Technical rept. 57-298, pt. 1; AD-130 823.
Order from LC mi$3.00, ph$6.30 PB 137 502

It is concluded that the recrystallized binary alloys are too low in hot strength to consider for use in moderate stress application at temperatures in excess of 1000°F. Special attention has been given to the development of higher hot strength alloys. The effect of titanium on hot strength is demonstrated. Some interesting and unique magnetic phenomena have been discovered in the binary alloys among which is a continuous change from ferromagnetic to antiferromagnetic behavior.

Minnesota U., Minneapolis.
REVIEW OF OBSERVATIONS ON THE CRACKING CHARACTERISTICS AND FRACTURES OF LABORATORY FATIGUE SPECIMENS, by L. J. Demer. Rept. on Materials Analysis and Evaluation Techniques, Contracts AF 33(038)20840 and N8onr-662(07). Sep 55,

51p. 68 refs. WADC Technical note 55-527; AD-93 051.
Order from LC mi$3.60, ph$9.30 PB 138 674

This review examines experimental observations relating to characteristics of the fatigue cracking and fracture of laboratory specimens both of single crystals of metals and polycrystalline metallic structures of various crystal habits. The sections deal with the formation and the paths of fatigue microcracks, the occurrence of fatigue macrocracks, the characteristics of fatigue fractures and certain associated phenomena, and the path of fatigue macrocracks under combined stresses. The object of the report is to provide background for further study of the mechanism of the fatigue process in metals.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
PREPARATION AND PROPERTIES OF EXPERIMENTAL BINARY COPPER-TITANIUM ALLOYS, by W. B. Steward, Jr. and R. C. Harris. June 56, 36p. 22 refs. Rept. R-1323.
Order from OTS $1.00 PB 151 173

The preparation, heat treatment, and properties of small experimental heats of wrought, age hardenable, binary copper-titanium alloys were investigated over the composition range of approximately 2 to 7 per cent titanium. These alloys were prepared both by induction-melting in air under a flux and by induction-melting in vacuum, using both titanium sponge and titanium scrap of commercial purity. The optimum combination of strength and formability appeared to occur in the vicinity of 94 per cent copper-6 per cent titanium where, by proper choice of heat treatment and degree of cold working, tensile strengths on the order of 160,000 psi accompanied by 3 to 5 per cent elongation were obtained. These properties lie between those of commercial copper-beryllium alloys containing 1 and 2 per cent beryllium. The hardness and tensile properties of vacuum-melted alloys showed no significant improvement over those obtained from air-melted alloys. The vacuum- and air-melted alloys also exhibited similar processing characteristics; both were fully amenable to normal cold working operations but possessed only moderate hot forgeability.

Ferrous Metals

Allegheny Ludlum Steel Corp., Watervliet, N. Y.
INVESTIGATION OF HIGH TEMPERATURE PROPERTIES OF 13 CR - 15 NI AUSTENITIC STEEL CONTAINING MO, W, TI AND B, by R. R. MacFarlane, E. E. Reynolds, and W. W. Dyrkacz. Final rept. on item 1, Contract AF 33(616) 258. 13 Oct 53, 30p. AD-23 435.
Order from LC mi$2.70, ph$4.80 PB 138 451

A steel containing 12.5 Cr - 15 Ni - 2 Mo - .4 W - .5 Ti - .10 B - .06 C was found to have outstanding stress-rupture properties in the range 1200° to 1500°F. These properties, as well as good room temperature tensile properties, were obtained by hot-cold working. Limited composition variations indicated that Mo, W, Ti, and B were beneficial and that C and Al were detrimental in their effects on rupture properties. Co had no apparent effect.

Armour Research Foundation, Chicago, Ill.
EFFECT OF FERRITE GRAIN STRUCTURE UPON IMPACT PROPERTIES OF 0.80% CARBON SPHEROIDITE, by M. Baeyertz, W. F. Craig, and E. S. Bumps. Rept. no. 24 (Technical) on Contract N6onr-274(01). 1 Apr 50, 34p. 12 refs. ATI-85 786.
Order from LC mi$3.00, ph$6.30 PB 138 906

The impact transition temperature of spheroidite from martensite with its small, interlocking, needle-shaped grains was contrasted with that of spheroidite from pearlite exhibiting larger equi-azed grains corresponding to the pearlite colonies. The spheroidite from martensite gave a considerably lower transition temperature.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
DEVELOPMENT OF LEAN-ALLOY CHROMIUM-NICKEL STAINLESS STEELS FOR HIGH TEMPERATURE USE, by J. Salvaggi and G. J. Guarnieri. Summary rept. on Contract NOa(s)52-368-c. 30 June 53. 62p. 19 refs. Rept. no. KA-797-M-7.
Order from LC mi$3.90, ph$10.80 PB 139 049

The austenitic chromiun-nickel stainless steels, of the "18-8" variety with and without molybdenum, were used as base analyses to which were made additions of titanium, boron, vanadium, zirconium, nitrogen, and carbon. Evaluation of the 100-hour rupture life was made at 1500° F. Significant gains in hot strength were made, particularly with titanium and boron added individually and in combination. The nominal 100-hour rupture strength at 1500° F is in the range of 18,000 to 20,000 p. s. i. for several of the titanium and boron modifications.

Crucible Steel Co. of America, Pittsburgh, Pa.
INVESTIGATION OF Fe-Mn-Cr-N-C SYSTEM FOR HEAT RESISTANCE AND OXIDATION RESISTANCE BETWEEN 1200 F AND 2000 F, by J. P. Tarwater and E. J. Dulis. Rept. for 1 Apr 57-31 Mar 58 on Metallic Materials, Contract AF 33(616)3318. Oct 58, 115p. 11 refs. WADC Technical rept. 57-242, pt. 2; AD-203 523.
Order from OTS $2.50 PB 151 558

Austenitic Cr-Mn-C-N steels containing various combinations of V, Nb, W, and/or Mo had, after heat-treating, room- and elevated-temperature tensile properties and creep-rupture strengths that compared favorably with those of such superalloys as A286 and Inco 901. Proper selection of composition and heat-treatment enabled development of adequate ductility in tension and creep rupture although a marked decrease in impact properties could not be avoided. Calcium additions improved the creep rupture strength of Cr-Mn-C-N steels that did not contain additions of strengthening elements (V, Nb, Mo, and W). A silicon addition of about 2% to high-chromium Cr-Mn-C-N steels increased the oxidation resistance at 2000 and 2200 F so that these steels compared favorably with

Type 310 stainless steel. Both strengthened and unstrengthened austenitic Cr-Mn-C-N steels could be hot-rolled to sheets without the formation of edge cracks or surface defects, but rolling pressures higher than those for Type 310 stainless steel were required.

Martin Co., Baltimore, Md.
AUTOCLAVE TESTING OF TYPE 304 STAINLESS STEEL, by L. E. Phillips. Final rept. on Contract DA 44-009-eng-3043, Task 1, phase 2. May 58, 61p. MND-E-1322.
Order from OTS $1.75 PB 151 149

AISI Type 304 stainless steel U-bend test specimens were subjected to corrosive water in rocker autoclaves. Oxygen and chlorides in the water were the only variables which contributed to the cracking of test specimens. The chloride level for cracking is dependent on test time. The oxygen level necessary to induce cracking was found to be approximately four per cent. Oxide film formation on stainless steel may be sufficient to induce stress corrosion cracking in the presence of chlorides, even if the environmental oxygen concentration is low.

Material Lab., New York Naval Shipyard, Brooklyn.
DYNAMIC PROPERTIES OF DUCTILE CAST IRON, by I. A. Schwartz. Final rept. on Lab. proj. 5435. Sep 55, 36p. 14 refs.
Order from LC mi$3.00, ph$6.30 PB 135 557

Charpy impact properties of ductile cast iron over a range of temperatures in comparison with those of Class "B" cast steel are reported. It was found that on the basis of transition temperature range and transition temperature the two materials are equivalent but from the standpoint of energy absorption, the steel is superior.

Light Metals

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TENSILE PROPERTIES OF ALCLAD 2024-T3 ALUMINUM AT ELEVATED TEMPERATURES FOR SHORT TIMES, by Louis B. Weckesser, Jr. Rept. on Contract NOrd-7386. Feb 56, 60p. 7 refs. CM-859.
Order from LC mi$3.60, ph$9.30 PB 136 428

Short-time elevated-temperature strength of Alclad 2024-T3 aluminum could not be determined by extrapolating existing high temperature data for 30-minute soak times and longer. A design which is based on high-temperature data for 30-minute soak times and which is subjected to a rapid temperature rise will be inadequate during the first ten minutes at temperatures around 400°F.

Armour Research Foundation, Chicago, Ill.
STUDY OF PHASE RELATIONSHIPS IN MAGNESIUM-LITHIUM-ALUMINUM ALLOYS, by A. W. Goldenstein, Arthur G. Metcalfe, and W. Rostoker. Final rept. for 1 July 56-15 June 57 on Contract DA 11-022-ORD-1972. Aug 57, 26p. 3 refs.
Order from OTS $0.75 PB 151 123

Mechanical properties of two magnesium-lithium based alloys produced on a scale simulating industrial practice were investigated. Experiments were carried out to determine proper melting and casting techniques, forging, rolling, and extruding characteristics. Tensile properties were obtained at -78.5°C, at 0°C, and at room temperature. Creep properties were studied at 50°C and 100°C.

[Defense Metals Information Center] Battelle Memorial Inst., Columbus, Ohio.
COMPILATION OF ELEVATED-TEMPERATURE PROPERTY DATA FOR TITANIUM AND SOME ALTERNATIVE METALS, by F. R. Schwartzberg, F. C. Holden and others. 17 Feb 58, 169p. 51 refs. Supplement to TML rept. no. 82, 10 Sep 57.
Order from LC mi$7.80, ph$25.80 PB 121 634S

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TENSILE PROPERTIES OF TITANIUM ALLOYS AT LOW TEMPERATURES, by F. C. Holden, F. R. Schwartzberg, and H. R. Ogden. Rept. on Contract AF 18(600)1375. 15 Jan 59, 47p. 16 refs. DMIC rept. 107; AD-207 911.
Order from OTS $1.25 PB 151 062

This report presents the information available to the Defense Metals Information Center on the tensile properties of titanium alloys at low temperatures. Some of the important factors that affect these properties are alloy composition, interstitial content, and microstructure. Sensitivity to notches generally is increased as the temperature is lowered. Unalloyed titanium shows increased strength as the temperature is decreased. Ductilities are decreased at very low temperatures, but remain adequate as low as -320 F. Low-temperature ductility is decreased by high interstitial content. For the alloys, reasonable ductilities at -320 F usually can be obtained, provided that the interstitial content is kept low. Ductility at low temperatures is higher for alloys when the microstructure is equiaxed, rather than transformed. Most of the alloys tested showed low ductility at -423 F. Excessive hydrogen causes a strain-rate-sensitive loss of ductility in the temperature range from -100 to 0 F. Notch sensitivity is increased as the temperature is lowered, and most of the factors that decrease ductility also increase notch sensitivity. These include high interstitial levels and transformed, or acicular, microstructures. Alloys heat treated to high strength levels generally are more notch sensitive than the same alloys in the annealed condition.

Dow Chemical Co., Midland, Mich.
LIQUIDUS DETERMINATIONS OF POLYNARY MAGNESIUM ALLOYS. Final status rept. for 1 Dec 49-15 Apr 50 on Contract N9onr-859(00). 29p. 2 refs. Rept. no. 15004; ATI-122 337.
Order from LC mi$2.70, ph$4.80 PB 136 675

Of the systems, Mg-Al-Sn, Mg-Al-Ca and Mg-Pb-Bi, two quasi-binaries were discovered, namely, $Mg_{17}Al_{12}$-Mg_2Sn and Mg-Al_2Ca. The eutectic in the first system occurs at 455°C with about 5% Mg_2Sn, while in the second system the eutectic is between 70 and 80% Mg at a temperature of 535°C. No ternary eutectics were established.

Massachusetts Inst. of Tech., Cambridge.
CONSTITUTION OF TITANIUM-TANTALUM-CARBON ALLOYS, by John Garvin McMullin. Doctoral thesis. Technical rept. no. 4 on Contract N5ori-078(17). 10 June 52, 55p. 15 refs. ATI-162 621.
Order from LC mi$3.60, ph$9.30 PB 137 255

An 1820°C isothermal cross section of the titanium-tantalum-carbon ternary diagram was prepared from x-ray diffraction and metallographic data. TiC and TaC were shown to form a continuous series of solid solutions with a range of from 50 to 40 atomic percent carbon on the TaC side widening to 48 to 22 atomic percent carbon on the TiC side. At temperatures above the titanium transition temperature titanium and tantalum form a complete series of solid solutions containing up to two atomic percent carbon. Ta_2C was found to have no solubility for titanium.

Materials Advisory Board, National Research Council, Washington, D. C.
RESULTS OF TESTS EVALUATING COMPRESSION TESTING TECHNIQUES OF SHEET MATERIALS AT ELEVATED TEMPERATURES, by George Gerard, Samuel A. Gordon and others. Rept. of the Task Force on Uniform Procedures for Structural Design Data Collection on Contract DA 36-039-sc-76439. 7 Mar 58, 23p. 2 refs. Rept. no. MAB-122-M.
Order from LC mi$2.70, ph$4.80 PB 136 402

The compression jigs reported herein utilizing solid, opposed or offset groove guides as well as the ball bearing type guides appear to result in satisfactory performance as viewed from the standpoint of friction. With the use of a satisfactory compression jig, the overall strain measuring systems with an accuracy of less than ± 2 percent were able to obtain average values of E within ± 5 percent of the reference values in practically all cases.

Materials Advisory Board, National Research Council, Washington, D. C.
UNIFORM TESTING PROCEDURES FOR SHEET MATERIALS. PART 1. GENERAL PROCEDURES. PART 2. TENSION TEST, by George Gerard, Samuel A. Gordon and others. Rept. no. 2 of Task Force on Uniform Procedures for Structural Design Data Collection on Contract DA 49-025-sc-83. 31 May 57, 12p. 4 refs. Rept. no. MAB-118-M.
Order from LC mi$2.40, ph$3.30 PB 136 404

Uniform testing techniques for high-temperature design is needed. To provide some basis for uniformity in evaluating various titanium alloys, a uniform set of procedures is being prepared for procuring the data. Adherence to these procedures will make it possible for several laboratories to perform the tests and the data can then be compared on a uniform basis.

Materials Advisory Board, National Research Council, Washington, D. C.
UNIFORM TESTING PROCEDURES FOR SHEET MATERIALS. PART 4. BEARING TEST. PART 6. CRIPPLING TEST, by George Gerard, Samuel A. Gordon and others. Rept. no. 3 of Task Force on Uniform Procedures for Structural Design Data Collection on Contract DA 49-025-sc-83. 27 Nov 57, 12p. Rept. no. MAB-121-M.
Order from LC mi$2.40, ph$3.30 PB 136 403

Bearing and Crippling tests on titanium sheet materials. Specimen preparation-loading-instrumentation, -test data-dimensions of specimens.

Minnesota U., Minneapolis.
GRAIN SIZE EFFECTS ON FATIGUE AND THEIR RELATIONSHIP TO NOTCH GEOMETRY, STRESS GRADIENT AND SIZE OF SPECIMENS, by F. H. Vitovec. Rept. for Jan 57 - July 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5449; Continuation of Contract AF 33(616)2803. Dec 58, 39p. 17 refs. WADC Technical rept. 58-539; AD-206 665.
Order from OTS $1.00 PB 151 598

A study was conducted on the effect of grain size, size of specimen and stress gradient on the direct stress fatigue strength of a 2.5 Al-magnesium alloy at room temperature. Specimens with three different grain sizes and seven different notch sizes were used in this investigation. The data are analyzed with regard to relationships between grain size, size of notch, relative stress gradient, stress gradient per grain, and theoretical strength of notched specimens.

North American Aviation, Inc. Downey, Calif.
STATUS OF TITANIUM ALLOY DEVELOPMENT PROGRAM, by C. W. Handova and J. T. Milek. Progress rept. no. 2 on Contract W33-038-ac-14191. Nov 54, 12p. 19 refs. Rept. no. AL-2064-1; AD-49 812.
Order from LC m8$2.40, ph$3.30 PB 135 549

The evaluation of vacuum degassing of formed parts made of Material II-A: 3 Mn-1 Al (Natanium) titanium alloy is in progress as a result of hydrogen embrittlement studies. Tear tests were made on Material II-A: 3 Mn-1 Al (Natanium-RS 110 BX) and correlated with hydrogen contents to evaluate the hydrogen embrittlement level.

Armour Research Foundation, Chicago, Ill.
MECHANICAL PROPERTIES OF CHROMIUM, by Arthur G. Metcalfe, Sheldon A. Spachner, and W. Rostoker. Rept. on Contract AF 33(616)2978. June 58, 78p. 20 refs. WADC Technical rept. 58-342; AD-202 559.
Order from OTS $2.00 PB 151 471

Vacuum melting in zirconia, cold crucible nonconsumable arc melting, and powder extrusion have been used for the consilidation of chromium and chromium alloys, using an electrolytic chromium containing 0.5% oxygen and 0.03% nitrogen. The cast ingots have been forged, warm-worked, and recrystallized to a controlled grain size. Some ingots have been extruded at low temperatures to achieve greater reductions of grain size. Grain size has been shown to have a small influence on the ductile-brittle transition temperature for this type of chromium. Heat treatment is very effective, under some conditions, in reducing the transition temperature, particularly when it reduces the yield stress. A theoretical analysis has been made to correlate these observations with the theory of the ductile-brittle transition. High recrystallization temperatures and resistance to grain growth above 1200°C characterized some of the extruded alloys. These alloys had high strengths at temperatures of 900°C and above. It has been shown that nitrogen alone is not responsible for the brittleness of chromium, whether in solution or as a precipitate. There appeared to be a correlation between a reduction of the yield stress and a reduction of the ductile-brittle temperature for one alloy, but it has been shown that some methods of raising the yield stress do not raise the transition temperature.

Atomic Energy Research Establishment (Gt. Brit.)
MECHANICAL PROPERTIES OF URANIUM-MOLYBDENUM ALLOYS, by M. B. Waldron, R. C. Burnett, and S. F. Pugh. 1958, 36p. 11 refs.
Order from BIS $0.95 AERE M/R 2554

The tensile properties and hardness of uranium-molybdenum alloys in the composition range 0-14 wt.% molybdenum have been studied at room and elevated temperatures. At lower concentrations, the breakdown of the γ solid solution to unstable microstructures leads to pronounced ageing effects. Above 5.5 wt.% molybdenum the γ solid solution is retained to room temperature and shows enhanced properties at temperatures up to 800°C.

Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF THE PROPERTIES OF TANTALUM AND ITS ALLOYS, by William D. Klopp, Fred R. Schwartzberg and others. Rept. for 1 May-31 July 58 on Metallic Materials, Contract AF 33(616)5668. Nov 58, 85p. 205 refs. WADC Technical Rept. 58-525; AD-206 073.
Order from OTS $2.00 PB 151 562

A survey of literature pertaining to tantalum and tantalum alloys has been carried as part of the study of the properties of tantalum and its alloys. The results of that survey are reported in narrative style with references to published data. A bibliography of available publications is included. Emphasis was placed on subjects pertinent to the research being conducted on this project with a more general coverage of other subjects.

Battelle Memorial Inst., Columbus, Ohio.
MOLYBDENUM AND MOLYBDENUM-BASE ALLOYS: MOLYBDENUM-THORIUM ALLOYS, by G. W. P. Rengstorff and R. B. Fischer. Phase rept. for 1 May-31 Aug 57 on Contract Nonr-1512(00). Sep 57, 18p.
Order from LC mi$2.40, ph$3.30 PB 135 724

Alloys containing 1, 3, and 5 per cent thorium were rolled, at 1000 F, to various amounts of reduction ranging from 50 to 93 per cent. They were then heat treated for 15 minutes at varying times from 1800 to 3200 F. This amount of reduction achieved at low rolling temperature directly from the as-cast ingot, and the resistance of the worked structure to recrystallization, are important results of this work.

Institute of Engineering Research, U. of California, Berkeley.
EFFECT OF DISPERSION ON THE TENSILE PROPERTIES OF ALUMINUM-COPPER ALLOYS, by R. B. Shaw, L. A. Shepard and others. Technical rept. 18 on Contract N7onr-295(02). 1 Apr 52, 45p. 9 refs. Series 22; Issue 18; ATI-167 503.
Order from LC mi$3.30, ph$7.80 PB 139 050

The yield strength and the rate of strain hardening increase uniformly with decreasing mean free path between the $CuAl_2$ particles in the alpha solid solution. These results were found to be valid covering test temperatures of 78°K to 295°K, and compositions of 3%, 4% and 5% Cu in high purity aluminum. The longarithm of the flow stress decreases linearly with the logarithm of the mean free path between the $CuAl_2$ particles.

Naval Engineering Experiment Station, Annapolis, Md.
INVESTIGATION OF PROPERTIES AND USES OF ALUMINUM BRONZES FOR SHIPBOARD APPLICATIONS: A SUMMARY OF WORK COMPLETED THROUGH SEP 1955, by W. Lee Williams. Feb 56, 133p. 53 refs. Evaluation rept. 040037B(22).
Order from LC mi$6.90, ph$21.30 PB 135 911

Test work to evaluate various cast and wrought aluminum bronzes for shipboard service. The experiments included a variety of sea water and fresh water corrosion tests on plain and welded alloys, as well as tension, torsion, fatigue, corrosion fatigue and magnetic permeability tests. Also experiments to evaluate the alloys for specific applications such as condensers, salt water piping, salt water pumps, reduction gears, bolts, propulsion shafting, shaft sleeves, propellers, valve trim, and fresh water stills.

Office of Scientific Research and Development. Div. 1.
SYNTHESIS OF CHROMIUM HEXACARBONYL [AND] PYROLYTIC PLATING OF CHROMIUM FROM THE VAPOR OF CHROMIUM HEXACARBONYL, by Benton B. Owen (Yale U.). Final rept. for 15 Mar 44-30 Sep 45 on Contract OEMsr-1318. 17 Sep, 8 Oct 45, submitted 14 Jan 46, declassified 15 Sep 58. 72p. 13 refs. OSRD rept. nos. 6472 and 6473; ATI-25 173.
Order from LC mi$4.50, ph$12.30 PB 136 563

Rem-Cru Titanium, Inc., Midland, Pa.
EFFECT OF STRAIN RATE ON THE MECHANICAL PROPERTIES OF TITANIUM-BASE MATERIALS, by D. R. Luster, W. W. Wentz, and J. P. Catlin. Rept. on Design and Evaluation Data for Structural Metals, Contract AF 33(038)21912. Sep 53, 164p. 28 refs. WADC Technical rept. 53-71; AD-22 977.
Order from LC mi$7.80, ph$25.80 PB 138 686

At intermediate rates of strain, high purity titanium is not significantly sensitive to strain rate changes. The presence of nitrogen in all commercial titanium-base materials is the probable reason for their high rate sensitivity at intermediate and low strain rates. Cold working and alloying also superimpose strain aging, recovery, and transformation effects.

Research Inst., U. of Michigan, Ann Arbor.
ELECTRON METALLOGRAPHIC STUDIES OF NICKEL-BASE HEAT-RESISTANT ALLOYS, by W. C. Bigelow and J. A. Amy. Rept. on Contract AF 33(616)3250. Aug 58, 57p. 33 refs. WADC Technical rept. 58-406; AD-155 767.
Order from OTS $1.50 PB 151 537

The very favorable high-temperature metallurgical properties of the nickel-base heat-resistant alloys result largely from the precipitation of the intermetallic γ' phase during exposure to high temperatures. Detailed studies of this precipitation reaction cannot be made by conventional optical metallographic techniques because the γ' particles are usually too small to be seen in the optical microscope when they exert maximum influence on the alloys' properties. A program of research has therefore been undertaken to utilize electron microscopy for this purpose. Methods are described which have proven satisfactory for polishing and etching nickel-base alloys for electron metallographic examinations. Extraction replica techniques for isolating γ' and carbide particles from the alloys for study by selected-area electron diffraction are also given. Electron microscopic studies have been made of the changes in microstructures of the commercial alloys, Inconel-X, Waspaloy, M-252, and Udimet-500, during aging at 1400° and 1600°F. Hardness variations are correlated with the precipitation of the γ' phase, and the possible mechanisms contributing to the observed variations are discussed. Electron diffraction studies have shown that the γ' phase has an ordered structure, and precipitates with a preferred orientation in the matrix. Lineal and spectrographic analyses indicate that the composition of the phase is more complex than is indicated by the usual formulas of Ni_3Al and $Ni_3(Al, Ti)$. Microstructural studies have been made of an experimental alloy of high Ti and Al content and of a cast nickel-base alloy. Investigations have been made to determine the nature of a banded structure which is associated with low rupture strength, and to study the influence of small additions of boron and zirconium on the precipitation of the γ' phase.

Structural Metallurgy and Corrosion

Armour Research Foundation, Chicago, Ill.
INVESTIGATION OF STATIC AND FATIGUE STRENGTH OF METALS SUBJECTED TO TRIAXIAL STRESSES, by William Lehrer and Harry Schwartzbart. Rept. for 1 Jan 56 to 30 Sep 57 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3237. Dec 57, 75p. 12 refs. WADC Technical rept. 58-430; AD-206 384.
Order from OTS $2.00 PB 151 594

The objectives of this program were: (1) the determination of the effect of triaxial stresses on fracture in static and dynamic loading and (2) determination of the brittle fracture strength of metal in the absence of any preceding plastic flow. To achieve these objectives, use was made of a composite brazed specimen consisting of a thin disk of soft metal between cylinders of hard metal. When a load is applied to the brazed bars, a triaxial stress condition is created due to the plastic restraint on the metal by the harder steel cylinder interfaces. Although base metals of mild steel and 4340 steel, and filler metals of lead, cadmium, and silver were utilized, significant data were obtained only with the silver filler metal and 4340 base metal. Experimental procedures and equipment were developed for producing sound and voidless brazements over a range of joint thicknesses for accurately measuring joint thickness and for determining the tensile and fatigue properties of such brazements with a minimum of scatter. The static tensile strength of silver butt brazements in 4340 steel increases with decreasing joint thickness of -1.5×10^{-4} in., and falls to a relatively constant value of 26,000 psi at thicknesses less that 4×10^{-5} in. The maximum strength is greater than 110,000 psi, some 7 1/2 times the strength of cast silver in uniaxial tension. The ultimate tensile strength of pure cast silver has been determined to be approximately 15,000 psi.

California Inst. of Tech., Pasadena.
APPLICATION OF ELECTRON PROBES TO LOCAL CHEMICAL AND CRYSTALLOGRAPHIC ANALYSIS, by Raymond Castaing (Paris U.). Thesis, tr. by Pol Duwez and David B. Wittry. Interim technical rept. no. 3 on Contract DA 04-495-ORD-463. 1 Dec 55, 161p. 28 refs. WAL 142/59-7.
Order from LC mi$7.80, ph$25.80 PB 135 428

Illinois U. [Engineering Experiment Station] Urbana.
CORROSIVE EFFECT OF MOLTEN SODIUM BORATE GLASSES UPON ENAMELING (INGOT) IRON, by Dwight G. Bennett and Robert J. Beals. Rept. no. 44 on Contract W33-038-ac-14520. Aug 49, declassified 6 Dec 55, 10p. AF TR-6073; ATI-67 675.
Order from LC mi$1.80, ph$1.80 PB 137 491

The corrosive action is selective and is not a direct function of either the Na_2O or B_2O_3 present. The corrosive effect of even the most reactive sodium borate glasses at temperatures of 1600-1800°F. is very much less than the corrosive effect of oxygen occurring when no glass covering is present.

Naval Civil Engineering Lab., Port Hueneme, Calif.
ACID INJECTION PREVENTS SCALE IN VAPOR COMPRESSION DISTILLATION UNITS, by J. S. Williams. Interim rept. on Feedwater Treatment in Vapor Compression Distillation Units, Proj. NY 512 035-2.01. 20 Dec 58, 24p. 4 refs. NCEL R-011; AD-203 971.
Order from OTS $0.75 PB 151 559

Results are given of an in-service type evaluation test for 1000 hours of intermittent acid injection equipment on a Navy stock 85 GPH model vapor compression distillation unit. It was found that 1.5 lb of sulfuric acid per 1000 gallons of water produced would keep the unit free of scale.

Naval Civil Engineering Research and Evaluation Lab., Port Hueneme, Calif.
USE OF ACID INJECTION FOR PREVENTION OF SCALE IN VAPOR COMPRESSION DISTILLATION UNITS, by J. S. Williams. 1 Sep 54, 11p. Technical note. N-210.
Order from LC mi$2.40, ph$3.30 PB 137 500

Citric acid and hydrochloric additions are studied and sand contact stabilizers.

Naval Ordnance Test Station, China Lake, Calif.
RAPID-HEATING STRESS-RUPTURE PROPERTIES OF SEVERAL ENGINEERING ALLOYS, by A. T. Robinson and J. D. Ramsdell. 2 Sep 53, 24p. 9 refs. NOTS-749; NAVORD rept. no. 2055; AD-19 297.
Order from LC mi$2.70, ph$4.80 PB 136 207

Equipment and technique for making Rapid-Heating-Rate Stress-Rupture tests on AISI 1015 steel, 18-8, and Inconel X at their respective service temperatures.

Ohio State U. Research Foundation, Columbus.
MATERIALS FOR HANDLING FUMING NITRIC ACID AND PROPERTIES OF FUMING NITRIC ACID WITH REFERENCE TO ITS THERMAL STABILITY, by Mars G. Fontana. Annual rept. no. 3, Apr 52- Mar Mar 53 on Contract AF 33(038)10381. Jan 54, 88p. 21 refs. AF TR-6519, pt. 3; AD-27 932.
Order from LC mi$4.80, ph$13.80 PB 137 489

Pitman-Dunn Labs. [Group], Frankford Arsenal, Philadelphia, Pa.
GASOLINE STORAGE TANK VAPOR PHASE CORROSION INHIBITOR TEST, W. J. Shields and A. Gallaccio. Aug 52, 19p. Memo. rept. MR-508.
Order from LC mi$2.40, ph$3.30 PB 136 411

To determine the effectiveness of the vapor phase corrosion inhibitor Shell VPI-260 in preserving ordnance materiel in bulk.

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Atomic Energy Research Establishment (Gt. Brit.)
SELECTED ABSTRACTS OF ATOMIC ENERGY PROJECT UNCLASSIFIED REPORT LITERATURE IN THE FIELD OF RADIATION CHEMISTRY AND BIBLIOGRAPHY OF THE PUBLISHED LITERATURE, 2nd ANNUAL SUPPLEMENT (PAPERS NOTED UP TO DECEMBER 1957) by R. W. Clarke. 1958, 330p. 1371 refs.
Order from BIS $7.82 AERE C/R 1575(1-6), Sup-2

Contents:
Section 1. Theory, interpretations, water and aqueous inorganic systems
Section 2. Organic compounds (including polymerisation reactions)
Section 3. Gaseous systems (excluding organic compounds)
Section 4. Solid systems (excluding organic compounds)
Section 5. Biochemistry and radiobiology (excluding animal studies, including irradiation of foodstuffs, etc.)
Section 6. Miscellaneous (including colloids, corrosion, industrial applications of radiation, irradiation equipment, general reviews and reports, etc.)

Palmer Physical Lab., Princeton U., N. J.
ELECTROMAGNETIC STRUCTURE OF THE NUCLEON, by P. Federbush, M. L. Goldberger, and S. B. Treiman. Rept. on [Contract AF 49(638)304]. [1958] 70p. 25 refs. AFOSR TN-58-499; AD-158 309.
Order from LC mi$3.90, ph$10.80 PB 136 265

Technical Research Group, New York.
CROSS SECTIONS FOR NEUTRON-INDUCED REACTIONS: A REVIEW OF PHENOMENOLOGICAL DESCRIPTIONS, by David M. Chase, Carl N. Klahr, and Aaron Temkin. Rept. on Contract AF 33(616)3616. Feb 58, 139p. 81 refs. TRG Rept. no. 10-14; WADC Technical rept. 58-79; AD-155 849.
Order from OTS $2.75 PB 151 563

The descriptive framework for treating nuclear reactions and current phenomenological models and methods for calculating nuclear cross sections are reviewed with particular reference to neutron-induced events at energies up to~14 Mev. General scattering theory for two-body systems is developed. Resonance theory is described from an elementary point of view and results of the derivative-matrix formulation are discussed. In connection with the gross-structure (energy-average) problem and the continuum region, an account is given of the strong-interaction and optical models. The rotational-optical model for

deformed nuclei is described. The statistical model for branching ratios is developed in a general form. Considered in the course of this development are the generalized gross-structure problem, branching ratios in the limit of continuous density of residual levels, the relation of the statistical assumptions to resonance theory, and inclusion of radiative capture. Some comparison of calculations with experimental results is included.

Texas Nuclear Corp., Austin.
ELASTIC SCATTERING OF FAST NEUTRONS FROM OXYGEN AND NITROGEN, by Norman A. Bostrom, Ira L. Morgan and others. Rept. for 1 July 56-31 July 57 on Contract AF 33(616)3790. Sep 57, 89p. 16 refs. WADC Technical rept. 57-446; AD-131 049.
Order from LC mi$4.80, ph$13.80 PB 138 666

Instruments and Installations

[Army Signal Research and Development Lab.] Fort Monmouth, N. J.
GAMMA-RAY SPECTROSCOPIC ANALYSIS TECHNIQUE, by Stanley H. Ungar. 1 Nov 55, 14p. 3 refs. Technical memo. M-1707; AD-89 553.
Order from LC mi$2.40, ph$3.30 PB 136 683

The present paper develops a technique for analyzing the pulse height distributions associated with photoelectric and Compton absorption in crystals used in terms of the incident gamma spectral distribution.

United Kingdom Atomic Energy Authority.
ANTHOLOGY OF HEALTH PHYSICS DATA, by H. J. Dunster. 3rd ed. Oct 57, 55p. 25 refs.
Order from BIS $1.16 R & DB(W)TN-58, Ed-3

The report comprises a personal collection of data which have been found repeatedly useful in work on the problems of radiation protection. Some errors have been corrected, and the section on shielding has been completely revised, but no comprehensive revision of the other data has been attempted.

Nuclear Engineering and Power

Atomic Energy Research Establishment (Gt. Brit.)
EXPONENTIAL EXPERIMENTS FOR P. I. P. P. A. MK. I, by G. Bevan, P. W. Mummery and others. Nov 54, declassified June 58, 76p. 10 refs.
Order from BIS $2.81 AERE R/R 2602

A series of exponential experiments have been performed which were designed to provide criticality data for P. I. P. P. A. Mk. I and to systematically increase the amount of criticality data for gas-cooled graphite-uranium reactors in general. The experimental methods used and the method of analysis of the observations are both described in detail. Tables of the experimental observations are given together with the values of the Laplacian and the migration area asymmetry deduced from the analysis.

Atomic Energy Research Establishment (Gt. Brit.)
FLUX AND CROSS-SECTION MEASUREMENTS WITH FAST FISSION NEUTRONS IN BEPO AND DIDO, by C. E. Mellish, J. A. Payne, and R. L. Otlet. July 58, 21p. 10 refs.
Order from BIS $0.68 AERE I/R 2630

Contents
Part I. Fission neutron flux measurements
Part II. (n, p) and (n, α) cross-sections
Tables:
Calculated penetrabilities of some (n, p) reactions
Apparent contamination of pure Zn with Cu^{64} produced by the (n, p) reaction, for various pile positions
(n, p) and (n, α) cross-sections
Standard sources for counting
The effect of atomic number on the height of the Coulomb Barrier for (n, p) or (n, α) reactions with $\phi = 50$

David Taylor Model Basin, Washington, D. C.
RDR 4 INSTRUCTION MANUAL, DAVID TAYLOR MODEL BASIN ONE-DIMENSIONAL, ONE-GROUP TRANSPORT THEORY ROUTINE NO. 4 FOR NUCLEAR REACTOR DESIGN, by Charles W. Dawson and Erwin H. Bareiss. Dec 56, 11p. 2 refs. Rept. 1100, reprint of Applied Mathematics Lab. Technical rept. 19, Oct 56.
Order from LC mi$2.40, ph$3.30 PB 139 033

Minnesota U., Minneapolis.
DESIGN METHOD FOR REACTORS, by J. T. Ludwig. Final rept. for 15 Sep 52-15 Sep 54 on Contract DA 36-039-sc-42573. Oct 54, 367p. 27 refs.
Order from LC mi$11.10, ph$56.10 PB 135 858

The purpose of this project is the establishment of a design method for inductive reactors of the types used in electronic equipment. There are four general classes: power (filter) chokes, pulse (charging) chokes, audio frequency chokes, video frequency chokes. The program includes two tasks: study and research into the theoretical requirements for the optimum electrical, magnetic and insulation design of reactors and the establishment of a universal design method for these reactors.

Radioactivity

Convair, Fort Worth, Tex.
ANALYSIS OF AIR SCATTERING OF Co^{60} GAMMA RADIATION, by J. W. Keller and G. Gonzalez. Rept. on Contract AF 33(600)32054. 28 Dec 57, 27p. 4 refs. MR-N-183; NARF-57-61T.
Order from LC mi$2.70, ph$4.80 PB 139 021

The energy distribution of the singly scattered component of air-scattered radiation from a point isotropic source of monoenergetic gamma rays was calculated for comparison with measured spectral data for a Co^{60} source. The calculations were performed for a collimated detector. Comparison of measured and calculated spectra for collimator orientations of 10^{o}, 90^{o}, and 135^{o} from the source-detector axis indicates that in general the observed spectra cannot be predicted satisfactorily in terms of the singly scattered component only.

Convair, Fort Worth, Tex.
SPECTRAL AND ANGULAR DISTRIBUTIONS OF AIR SCATTERED Co^{60} GAMMA RAYS, by B. S. Burton, Jr. Rept. on Contract AF 33(600)32054. 18 Sep 57, 31p. 5 refs. MR-N-168; NARF-57-42T.
Order from LC mi$3.00, ph$6.30 PB 139 022

Angular and spectral distributions of air-scattered gamma-radiation from an isotropic Co^{60} source have been measured with a total-absorption gamma-ray spectrometer.

New York U. Coll. of Engineering, N. Y.
A LITERATURE SURVEY ON THE RELATIONSHIP BETWEEN DIMENSIONAL CHANGES PRODUCED BY RADIATION AND CRYSTAL CHANGES, By Irving B. Cadoff. Rept. for Oct 56-Oct 57 on Solid State Research and Properties of Matter, Contract AF 33(616)3868. June 58, 19p. 26 refs. WADC Technical rept. 58-325; AD-155 665.
Order from OTS $0.50 PB 151 548

The results of a survey of the literature dealing with nuclear irradiation effects in structural material indicate that dimensional instability due to lattice displacements should not be a significant effect. These results indicate, however, that induced transmutations may cause dimensional change. In the case of lattice displacements, there appears to be a correlation between growth anisotropy and crystal structure anisotropy.

Radiation Effects Information Center, Battelle Memorial Inst., Columbus, Ohio.
SURVEY OF IRRADIATION FACILITIES, by J. F. Kircher. Rept. on Contract AF 33(616)5171. 31 May 58. 76p. REIC rept. no. 7; AD-157 174.
Order from LC mi$4.50, ph$12.30 PB 139 042

This report presents a survey of irradiation facilities generally available to the Air Force and its contractors. Reactor facilities, gamma facilities, and high-energy machine sources have been included in this survey. Wherever possible, the information has been tabulated.

Stanford Research Inst., Calif.
EFFECTS OF HIGH ENERGY, HIGH INTENSITY ELECTROMAGNETIC RADIATION ON ORGANIC LIQUIDS, by Robert M. Wagner and Leland H. Towle. Rept. for 1 May 57 - 30 Apr 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)3738. Oct 58, 52p. 14 refs. WADC Technical rept. 58-206; AD-202 499.
Order from OTS $1.50 PB 151 606

This study attempts to provide, through the study of several representatives of different types of organic structure, background information which may suggest methods of judicious choice for a given application. The following compounds were subjected to high energy electron bombardment: alkyl aromatic hydrocarbons, aromatic ethers, nitro aromatics, amino aromatics, and aliphatic mixed ether-alcohol types. Quantitative measurements were made of the amounts and types of radiolytic products formed. Inferences were drawn from such measurements concerning (1) the relative stability of compounds, and (2) the influence of functional groups upon such stability. Higher molecular weight compounds in general, and condensed aromatic ring systems in particular, are the most resistant to radiation. Aliphatic or heterophatic linkages between aromatic ring systems are sites of primary radiolytic scission. The extent to which species of higher molecular weight than parent material are formed is directly dependent upon the fate of the initial products of the scission of each radiolytically labile linkage. The primary products of scission may (1) hydrogenate and revert to stable form; (2) if energetic enough, they may attack parent material; or (3) they may condense with each other producing products comparable to the parent in molecular weight. Compounds possessing the ability to assume certain spatial configurations, allowing resonance effects to exist, may permit absorbed energy to be innocuously reduced to levels which are below that required to rupture the molecular structure. The presence of different functional groups on aromatic ring systems markedly influence the mode of radiolytic scission. These differences are reflected in either gas yield, polymer yield, or both. The data do not permit complete and unequivocal definition of either the mode of radiolytic decomposition or the delineation of the structure of all products detected.

Technical Research Group, New York.
A MONTE CARLO CODE FOR GAMMA RAY TRANSMISSION THROUGH LAMINATED SLAB SHIELDS, by Robert A. Liedtke and Herbert A. Steinberg. Rept. on Research Concerned with Advancing the State-of-the-Art in Gamma-Ray and Neutron Shielding Technology, Contract AF 33(616)3616. Apr 58, 141p. 9 refs. WADC Technical rept. 58-80; AD-203 641.
Order from OTS $2.75 PB 151 605

An IBM 704 Monte Carlo code for computing the transmission of monenergetic and monodirectional gamma rays by a multilayered slab geometry shield is described. The main output data are the total energy current and flux. The associated energy spectra of each accompanied by their standard deviations are also obtained but at lesser accuracy. Extensive use is made of variance reduction techniques, including use of calculated first collision points, a modified form of the exponential transformation, and statistical estimation of the transmission after each collision. Importance sampling is used for choosing the recoil energy and the change in azimuthal angle following collision. Results are quoted for Compton scattering medium and for a selected group of one,

two, and three slab lead-water shields. Comparisons are made with infinite medium results corrected in a plausible manner for edge effects. They are interpreted as permitting the use of an empirical formula due to M. Kalos for two-slab lead-water shields for a large number of situations of interest. The energy spectra are also discussed.

Waste Disposal

Atomic Energy Research Establishment (Gt. Brit.)
DESIGN OF AIR EJECTOR FOR USE IN RADIOACTIVE LABORATORIES, by J. R. Catlin and L. D. G. Coward. Nov 52, declassified Mar 58. 10p. 2 refs.
Order from BIS $0.37 AERE E/M 63

A design is evolved for the economic manufacture of a vacuum ejector to produce 25.3" of Hg vacuum, for use in lieu of water/air ejectors where the production of effluent such as in radiochemical laboratories may be a disadvantage.

Atomic Energy Research Establishment (Gt. Brit.)
EXERCISE MERMAID, by P. Bowles, R. H. Burns and others. Aug 58, 231p. 20 refs.
Order from BIS $6.53 AERE E/R 2625

The exercise was performed because of the proposal to erect an Atomic Energy Research Establishment at Winfrith Heath, Dorset. This proposal would involve continued discharge of radioactive liquid effluent into the sea, preferably off Arish Mell Gap on the Dorset coast. Following the precedent at Windscale, trials were initiated to measure the dispersal rate of soluble effluent, simulated by fluorescent dye, from various points south of Arish Mell and also to supplement Admiralty tidal stream data in this area. The objects were to determine the optimum position of the outfall from safety and economic aspects and to obtain fundamental data for estimating the contamination likely to arise from the discharge of radioactive material. It is anticipated that such data will be of use for all types of sea discharges in other locations.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Air Crew Equipment Lab., Naval Air Experimental Station, Philadelphia, Pa.
EFFECTS OF MODERATE HEAT STRESS, ALTITUDE, AND TIME ON THE DEHYDRATION RATE OF SUBJECTS WEARING THE VENTILATED FULL PRESSURE SUIT, by L. M. Libber, H. R. Greider and L. J. SantaMaria. 11 June 57, 15p. 3 refs. NAMC-ACEL-342.
Order from LC mi$2.40, ph$3.30 PB 136 003

The effects of altitude, time and a subjectively designated comfortably warm state on various measures of water loss were studied. Altitude had little effect on any of the dependent variables. Future recommendation is made to incorporate some method of oral inflight fluid intake by the pilot.

Quartermaster [Research and Engineering Center] Natick, Mass.
PREPARATION OF ANTHROPOMETRIC NOMOGRAPHS, by Ella H. Munro. Feb 52, 21p. Rept. no. 184.
Order from LC mi$2.70, ph$4.80 PB 137 458

Seven analyses of Army populations were made in order to present the interrelationships between selected bodily dimensions and two independent dimensions, varying according to the analysis. Each analysis has resulted in a nomograph which is the graphic representation of the interrelationships.

School of Aviation Medicine, Randolph [AFB] Tex.
PRESCRIPTION SPECTACLES FOR FLYING PERSONNEL, by Wayne E. Gulley, Theodore C. Leininger, and J. Gordon Wells. Special rept. Nov 52, 8p. 5 refs.
Order from LC mi$1.80, ph$1.80 PB 135 473

PHYSICS

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
TECHNICAL PAPERS FROM THE QUARTERLY REVIEW OF BUMBLEBEE ACTIVITIES, JULY-DECEMBER 1957. Rept. on Contract NOrd-7386. 51p. 11 refs. Bumblebee rept. no. 274.
Order from LC mi$3.60, ph$9.30 PB 136 560

Contents:
Frequency-regulated hydroelectric missile power supply, by R. T. Ellis and T. W. Sheppard
Free-flight skin-friction measurements, by F. W. Fenter and W. C. Lyons, Jr.
Interference effects among static-pressure probes in supersonic flow, by J. L. Lindsey
Characteristics of silicon-diode switch demodulators, by R. E. Gorozdos and R. L. Konigsberg
Techniques of smoothing discrete data and their applicability to track-while-scan systems, by J. E. Hanson and J. W. Follin, Jr.
Measurements of molecular diffusion coefficients, by A. A. Westenberg and R. E. Walker
Measurement of skin friction by surface impact pressure probes, by F. W. Fenter and C. J. Stalmach, Jr.

Acoustics

Acoustics Lab., Mass Inst. of Tech., Cambridge.
QUARTERLY REPORT, JULY-SEPTEMBER 1957, Final rept. on Contracts AF 19(604)2051,

AF 19(604)2061, AF 33(616)3307, and Nonr-1841(42). 1957, 39p. 32 refs.
Order from LC mi$3.00, ph$6.30 PB 136 062

Contents:
Acoustics Laboratory
A terminal analog of fricative consonant articulation
Measurements of the transient response of the vocal tract
Analog speech synthesizer
Speech bandwidth compression system
Auditory tests
A wide-range electrostatic loudspeaker
Excitation of damped resonators by wind
Sound field generated inside a cylinder by a simple harmonic ring source
The diffraction of a plane sound wave by a semi-infinite thin elastic plate
The effect of a reflecting plane on the power output of a simple sound source
Measurement of the noise produced by interacting jets
Dispersion relation for flexural waves
Internal friction of solids
Field measurements of sound propagation

Armed Forces-NRC Committee on Hearing and Bio-Accoustics, Washington, D. C.
INSTRUMENTATION FOR THE MEASUREMENT AND GENERATION OF HIGH INTENSITY SOUND, by L. L. Beranek, J. K. Hilliard and others. Technical rept. no. 14 on Contract Nonr-1151(01). Sep 57, 136p. CHABA memo. rept. no. 4.
Order from LC mi$6.80, ph$21.30 PB 139 026

There have been many recurring questions about the capabilities and the availability of instruments for measurement and for generation of noise at sound pressure levels in excess of 130 db. Considerable information exists, but it is scattered through the scientific literature and special commercial and military reports. This Memorandum Report attempts to compile some of this information. This report does not attempt to recommend particular instruments for each of the many uses that are possible. The combinations of requirements which must be met for many measurement tasks are too complex for simple tabulation. The report does include the specifications and performance data which the user generally needs in order to select the most suitable instrument. The user must first know the requirements for his particular task and then choose accordingly.

Armour Research Foundation, Chicago, Ill.
SOUND PROPAGATION NEAR THE EARTH'S SURFACE AS INFLUENCED BY WEATHER CONDITIONS, by R. W. Benson and H. B. Karplus. Rept. on Propagation of Sound Waves Near the Earth's Surface, Contract AF 33(616)2470. Mar 58, 40p. 5 refs. WADC Technical rept. 57-353, Pt. I; AD-130 793.
Order from LC mi$3.00, ph$6.30 PB 137 359

The influence of various weather conditions on sound propagation in the atmosphere has been studied. The source was a propeller type aircraft flown at altitudes up to 4800 feet and distances up to 9600 feet. The propagation was studied for angles of elevation with respect to the earth's surface of 14-$\frac{1}{2}^{o}$, 30°, and 90°. Noise data were collected for 1300 passes of the airplane over and around a ground observing point. The weather conditions varied during a year's time to include typical weather conditions which were available in the area of Chicago, Illinois.

Electronics Research Labs., Columbia U., New York.
THE TEMPERATURE AND HUMIDITY DEPENDENCE OF SOUND ABSORPTION, by I. Horiuchi. Technical rept. TR-7 on Project Michigan, Contract DA 36-039-sc-52654, 1 Nov 57, 23p. 7 refs. CU-4-57-UM(sub)EE.
Order from LC mi$2.70, ph$4.80 PB 137 790

Results have been obtained for the absorption of low frequency sound in humid air at temperatures of 0° C and 55° C. The pressure ranged from 20 cm Hg to atmospheric, while the relative humidity (r.h.) was varied from 2 per cent r.h. to 80 per cent. The frequencies employed were the first five radial modes of a 66-inch spherical resonator: 300, 500, 700, 900, and 1100 cps, approximately. The experimental results show the absorption to follow the Knudsen-Kneser theory closely, except that under extreme relative humidity conditions large departures are found to occur.

Electricity and Magnetism

Naval Ordnance Lab., White Oak, Md.
STABLE MAGNETIC CORES FROM NON-STRATEGIC ALFENOL POWDER, by Edmond Adams and William M. Hubbard. 9 Nov 55, 18p. 4 refs. NAVORD rept. 4151.
Order from LC mi$2.40, ph$3.30 PB 138 504

The powdered high resistivity 16 per cent aluminum-iron alloy with and without minor additions was investigated as a non-strategic material substitute for powdered high nickel alloys, such as 2-81 Molybdenum-Permalloy alloy, now used in loading and filter coils.

Virginia Inst. for Scientific Research, Richmond.
THIN FERROMAGNETIC FILMS, by G. Wayne Clark, Calvin O. Tiller and others. Progress rept. no. 2, 27 July-27 Oct 56 on Contract DA 49-170-sc-1971. Mar 57, 24p.
Order from LC mi$2.70, ph$4.80 PB 137 393

The longitudinal Kerr magneto-optic method of magnetic domain observation has been used to study the macroscopic behavior of the antiparallel domains of a 2800 A° thick evaporated film of Ni-Fe (82% Ni). Photographs of this sample are shown to illustrate uniaxial anisotropy and the existence of a small unidirectional anisotropy.

Westinghouse Electric Corp., East Pittsburgh, Pa.
THE EFFECT OF TEMPERATURE ON THE A-C MAGNETIC PROPERTIES OF NICKEL-IRON ALLOYS, by J. J. Clark and J. F. Fritz. Rept. on Solid State Research and Properties of Matter, Contract AF

33(616)309. Aug 58, 44p. WADC Technical note 58-277; AD-203 397.
Order from OTS $1.25 PB 151 601

The effect of temperature on the a-c magnetic properties of six nickel-iron alloys is reported for the temperature range -60°C to +250°C. The alloys are: Hipernik, Hipernik V, Deltamax, Hymu 80, Supermalloy, and 4-79 Mo-Permalloy. Curves are presented which show the variation with temperature of total core loss and rms exciting volt-amperes for three frequencies: 60, 400, and 1000 cycles per second.

Electronics

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
EFFECTS OF SELECTIVE FADING ON AM. SIGNALS, by Warren D. Nupp. Technical note. 13 Dec 57 13p. 7 refs. NADC-EL-N57103.
Order from LC mi$2.40, ph$3.30 PB 137 657

Atomic Energy Research Establishment (Gt. Brit.)
HYDROMAGNETIC INSTABILITIES OF A CYLINDRICAL GAS DISCHARGE. 2: INFLUENCE OF VISCOSITY, by R. J. Tayler. May 56, declassified July 57. 41p. 8 refs.
Order from BIS $1.04 AERE T/R 1888

In a previous report hydromagnetic instabilities of an inviscid perfectly conducting plasma were considered. The results obtained were a generalisation of those previously found by Kruskal and Schwarzschild, and in common with these they predicted that disturbances of the shortest wavelength were intrinsically the most unstable. This cannot be true in the presence of viscosity because of the large viscous stresses which would be called into play, and this report demonstrates the existence of a mode of maximum instability, and obtains a first approximation to the value of the corresponding wave number.

Electronic Defense Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
NOTES ON SCATTERING BY GRATINGS, by Victor Twersky. Rept. on Contract DA 36-039-sc-71053. May 57, 37p. 18 refs. Technical memo. no. EDL-M105.
Order from LC mi$3.00, ph$6.30 PB 135 338

These notes are a supplement to a theory of the grating amplitudes based on a new type of functional equation relating their multiple and single scattered values; the relation is of the form of an inhomogeneous integral equation with the integration operation replaced by the difference of summation and integration operations over the analogous ranges. We consider further the physics of this new model, and make additional applications and comparisons with other theories; this may facilitate the use of the results for practical problems involving the usual finite, near-periodic arrays.

Electronics Research Lab., U. of California, Berkeley.
AN ANALYSIS OF ELECTRON BEAM INTERACTION WITH EMPHASIS ON THE CROSSED FIELD PROBLEM, by J. Wilhelm Kluver. Rept. on Contract AF 33(616)3278. Oct 58, 86p. 19 refs. WADC Technical rept. 58-174; AD-204 794.
Order from OTS $2.25 PB 151 551

A general method of approach for the approximate solution of the small-signal perturbation of a bounded electron stream surrounded by a periodic structure is developed. The electron stream is described on the basis of the Maxwell-Boltzmann equations with the requirement that energy be conserved. The perturbation of the dynamic equations is carried out and its effect on a defined boundary of the electron stream is discussed. Starting from the Lorentz reciprocity theorem in its complex form, the approximate boundary conditions for the RF electric field at an equivalent surface of the periodic structure are derived. The characteristic waves are found by employing the discontinuity conditions at the beam boundary. A power theorem describing the conversion RF kinetic energy into electromagnetic energy is given. The method of analysis is applied to some examples including a thin, rectilinear, multi-velocity stream focused by crossed electric and magnetic fields. The characteristic equation for the latter system is derived and several possible models for beam-type magnetron interaction are discussed. The application of the initial conditions for electron streams is discussed.

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT, 1 OCTOBER-31 DECEMBER 1956, by S. Silver. Progress rept. no. 15 on Contract N7onr-295(29). Jan 57, 21p. Series no. 60, Issue no. 15.
Order from LC mi$2.70, ph$4.80 PB 135 551

The object of this experimental study is to measure both the relative phase and intensity of the diffractional field produced by a plane wave incident on a circular aperture in an opaque screen, where the angle of incidence of the plane wave is arbitrary. Only measurements of the tangential electric field in the plane of the aperture will be made, since complete knowledge of this field will permit vigorous calculation of the transmitted field on the shadow side of the screen. During the previous quarter the instrumentation for the experiment was completed and field measurements for the normal incidence case were begun.

Electronics Research Labs., Columbia U., New York.
A MODIFICATION OF THE WALD SEQUENTIAL PROBABILITY RATIO TEST AS APPLIED TO RADAR DETECTION, by Lee Abramson. Technical rept. T-10/133 on Contract AF 19(604)1572. 29 Aug 58, 33p. 2 refs. CU-17-58-AF-1572-ERL; AFCRC TN-58-395; AD-160 852.
Order from LC mi$3.00, ph$6.30 PB 137 248

For a fixed false alarm probability α and a fixed miss probability β the Wald sequential probability ratio test (SPRT) minimizes the average time $\bar{T}$ to decide between signal-plus-noise and noise alone, regard-

less of which is the true state. However, this optimal property of the SPRT is misleading since the SPRT is designed to detect a fixed signal, while the true signal may vary over a large range. Consequently, $\bar{T}$ may be quite large in cases which are really of little interest. This study investigates a modification of the SPRT which results in a smaller maximum $\bar{T}$ at the expense of a larger minimum $\bar{T}$. Of course, the value of the modification depends upon the relative magnitudes of these changes.

Molecular Physics and Spectroscopy

Arkansas U., Fayetteville.
THE DEVELOPMENT OF AN RF MASS SPECTROMETER FOR THE STUDY OF COMBUSTION PROCESSES, by M. K. Testerman. Rept. on Contract AF 33(616)5045. July 58, 144p. 8 refs. WADC Technical rept. 58-429; AD-155 898.
Order from OTS $2.75 PB 151 473

A unique sampling system has been designed for the RF mass spectrometer to adapt the instrument for studies on the reaction mechanism of combustion. The products of combustion are introduced directly into the RF mass spectrometer tube through a sampling nozzle which allows the gaseous products to enter at atmospheric pressure and finally introduces them into the RF mass spectrometer tube at pressures of 10^{-4} to 10^{-5} mm. This is accomplished with a probe that contains a series of aligned orifices which are differentially pumped and which form a molecular beam from the sample being introduced. The molecular beam is supposed to be modulated at a 30 cps rate within the sampling probe so that the mass spectrometer can discriminate against the incoming molecular beam and the background gases with the tube. Several modulating devices were investigated, and a mechanical system was chosen. During the testing phase to determine the performance of the sampling probe and the beam chopping system it was found that a suitable synchronizing signal was not obtained due to unexpected backlash in the mechanical system. The instrument described is also capable of performing batch analysis of gases. Other features of the instrument such as special circuits, vacuum system requirements, and design criteria are described in this report. The principles of operation of the RF mass spectrometer tube and associated electronic circuits are presented, along with the results of analytical tests made with the instrument. Investigations of rhenium emitters as the source of ionizing electrons in a mass spectrometer have also been made and the results of these tests are presented.

Miami U., Coral Gables, Fla.
ELECTRON ENERGY BANDS IN SODIUM, by Joseph Callaway. Rept. on Contract AF 49(638)62. June 58, 13p. 9 refs. AFOSR TN-58-503; AD-158 314.
Order from LC mi$2.40, ph$3.30 PB 136 076

The potential energy of a valence electron in sodium is represented by the function $V(r) = -2/r + Ae^{-\beta r}/r$. The second term, which is repulsive in character, represents the effect of the core electrons. Values for A and β are determined from spectroscopic data. Energy levels of predominately S and p symmetry are determined at four points of Brillouin Zone.

Optics

Frankford Arsenal, Philadelphia, Pa.
DISCUSSION OF A STADIAMETRIC RANGEFINDER DEVICE AS AN ADJUNCT TO A STANDARD OPTICAL OBSERVATION INSTRUMENT, by W. W. Hollis and M. D. Flanagan. 25 Sep 57, 12p. Technical note no. TN-1095.
Order from LC mi$2.40, ph$3.30 PB 136 105

Institute of Optics, U. of Rochester, N. Y.
SIMPLE WIDE RANGE SPECULAR REFLECTOMETER by Richard F. Weeks. Rept. on Contract AF 18(600)193. May 58, 12p. AFOSR TN-58-513; AD-158 324.
Order from LC mi$2.40, ph$3.30 PB 136 264

A wide range absolute specular reflectometer of simple design has been built to measure the absolute reflectivity of single crystals at liquid nitrogen temperature. The basic design theory of operation and inherent limitations of the design are discussed in terms of the spectra and temperature regions attainable. The instrument built at the Institute of Optics is shown as well as samples of measured reflectivities.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
DEVELOPMENT OF INTERFEROMETRY FOR THE INFRARED SPECTRAL REGION USING TELLURIUM FILMS, by Robert G. Greenler. Rept. on Contracts Nonr-248(01) and AF 19(604)949. 1 Feb 57, 81p. 43 refs.
Order from LC mi$4.80, ph$13.80 PB 135 525

This work describes an investigation of the suitability of evaporated tellurium films for use as high index of refraction components in multilayer films for the infrared. New interferometer films have been developed using tellurium layers and their infrared characteristics have been measured. Multilayer-film interference filters for the infrared have been developed using tellurium layers. These new films and filters have been incorporated into a scanning Fabry-Perot interferometer for use in the infrared.

Polaroid Corp., Cambridge, Mass.
INFRA-RED TRANSMITTING WINDOWS AND FILTERS, by Mark Hyman, Jr. Summary rept. on Contract NOrd-6013. 13 Dec 45, 23p.
Order from LC mi$2.70, ph$4.80 PB 136 058

Wayne State U., Detroit, Mich.
THEORETICAL INVESTIGATIONS ON THE LIGHT SCATTERING OF COLLOIDAL SPHERES IV. SPECIFIC TURBIDITY IN THE LOWER MICROSCOPIC RANGE AND FINE STRUCTURE PHENOMENA, by Wilfried Heller and H. James McCarty. Technical rept. no. 29 on Contract Nonr-736(00). 15 Feb 58, 16p.
Order from LC mi$2.40, ph$3.30 PB 137 802

Additional calculations were carried out on the scattering cross sections of spheres and the specific turbidities of their dispersed systems using again the Mie-theory. The parameters considered were $\alpha = 7.0(0.2)25.6$ and $m = 1.05(0.05)1.30$. The close spacing of the α-values allowed the detection of a fine structure of regular period in the $(\tau/c)_0(\alpha)$-curves and related curves. The fine structure is explained as the result of interferences of secondary magnitude.

Solid State Physics

Antenna Lab., Calif. Inst. of Tech., Pasadena.
ANISOTROPIC EFFECTS IN GEOMETRICALLY ISOTROPIC LATTICES, by Z. A. Kaprielian. Technical rept. no. 16 on Contract AF 18(600)1113. 31 Mar 58, 36p. 5 refs. AFOSR TN-58-569; AD-158 388.
Order from LC mi$3.00, ph$6.30 PB 136 164

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, by H. E. Farnsworth, J. A. Dillon, Jr. and R. E. Schlier. Scientific rept. no. 7, 1 Mar - 31 May 58, on Contract AF 19(604)1952. June 58, 18p. 3 refs. AFCRC TN-58-153; AD-152 384.
Order from LC mi$2.40, ph$3.30 PB 135 506

The low-energy electron diffraction work on silicon has been extended to a (111) face of a "floating-zone" refined crystal cut from a sample with a resistivity of 1600-2000 ohm-cm and a lifetime of 1100-1500 μsec. The effects of quenching and annealing and ion-bombardment were observed.

Eaton Electronics Research Lab., McGill U. (Canada)
ELECTROMAGNETIC PROPERTIES OF OBSTACLE-TYPE DIELECTRICS WITH REGULAR AND IRREGULAR STRUCTURES, by H. J. Peppiatt. Technical rept. no. 30 on Contract AF 19(122)81. Sep 53, 43p. 18 refs. AD-26 085.
Order from LC mi$3.30, ph$7.80 PB 137 652

It has been shown quantitatively that the diamagnetic effect of large flake like metal powder artificial dielectrics is smaller than predicted by simple theories. Measurements were made on regular arrays of aluminum discs of uniform circular contour in an attempt to isolate the main causes of this effect. To do this the theory of the Short circuit - Open circuit waveguide method was enlarged in scope to treat certain media of electric and magnetic anisotropy. Experimental values of the real and imaginary parts of the tensor components were obtained.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
DIFFUSION OF SILVER, COPPER, COBALT AND IRON IN GERMANIUM, by Ling Yun Wei. Technical note no. 4 on Contract AF 18(600)1310. Aug 58, 97p. 58 refs. AFOSR TN-58-853; AD-203 496.
Order from LC mi$5.40, ph$15.30 PB 137 995

The diffusivities of these elements in Ge are very great, in the range of 10^{-5} - 10^{-7} cm^2/sec at temperatures around 800°C. The diffusivities are higher in low dislocation (less than 10^3 pits/cm^2) than in high dislocation (around 10^5 pits/cm^2) crystals. The solubilities in Ge are very small. Diffusion does not follow Fick's law. All these characteristics are in sharp contrast with those observed in diffusion of Group III and V elements in Ge or Si.

Illinois U., Urbana.
ON THE EFFECT OF NON-EQUILIBRIUM VACANCIES ON THE KINETICS OF KIRKENDALL DIFFUSION, by H. Fara and R. W. Balluffi. Rept. on Contract AF 18(603)106. Sep 58, 19p. 18 refs. AFOSR TN-58-690; AD-162 224.
Order from LC mi$2.40, ph$3.30 PB 136 388

Vacancy diffusion models which predict parabolic diffusion-penetration kinetics implicity assume that vacancy equilibrium is maintained everywhere. It is concluded that non-parabolic effects are probably of little importance in usual face-centered-cubic metallic systems by the time diffusion measurements are made by conventional sectioning methods; i.e., when $Dt \gtrsim 10^{-5}$ cm^2.

Mineralogical Lab., U. of Michigan, Ann Arbor.
PRESSURE-BIREFRINGENCE RELATIONSHIPS IN SILICON SINGLE CRYSTALS, by A. A. Giardini. Quarterly progress rept. no. 1, 1 Nov 56-31 Jan 57, on Contract DA 36-039-sc-73114. Feb 57, 13p.
AD-129 726
Order from LC mi$2.40, ph$3.30 PB 136 086

A brief report is given of the progress made in research to obtain information of the piezobirefringence of silicon monocrystals. A combination precision diamond saw and surface grinder was designed and constructed for the preparation of prismatic single crystal specimens of various shapes, and a rigid concrete-cement block pier was made for supporting this unit.

Mineralogical Lab., U. of Michigan, Ann Arbor.
PRESSURE BIREFRINGENCE RELATIONSHIPS IN SILICON SINGLE CRYSTALS, by A. A. Giardini. Quarterly progress rept. nos. 2-3, 1 Feb-31 July 57, on Contract DA 36-093-sc-73114. 2 nos.
Order from LC

Quarterly progress rept. no. 2, 1 Feb-30 Apr 57, 21p. mi$2.70, ph$4.80, PB 136 085
Quarterly progress rept. no. 3, 1 May-31 July 57, 22p. mi$2.70, ph$4.80, PB 136 084
(See also PB 136 086)

Mineralogical Lab., U. of Michigan, Ann Arbor.
PRESSURE BIREFRINGENCE RELATIONSHIPS IN SILICON SINGLE CRYSTALS, by A. A. Giardini. Final rept. for 1 Nov 56-31 Oct 57 on Contract DA 36-039-sc-73114. Nov 57, 40p. 10 refs.
Order from LC mi$3.00, ph$6.30 PB 136 083

Directional grinding hardness of silicon and strontium titanate, adiabatic elastic constants, compressibility modulus, Poisson ratio, strain-optical constants of strontium titanate, and the stress-electrical behavior of strontium titanate was investigated. (See also PB 136 085)

Naval Ordnance Lab., White Oak, Md.
PREPARATION AND PURIFICATION OF INDIUM ARSENIDE, by Dorothy P. Enright. 15 Jan 58, 46p. 18 refs. NAVORD rept. 6024.
Order from LC mi$3.00, ph$7.80 PB 137 457

Indium arsenide was prepared in the furnace by either direct contact between the elements or by reacting arsenic vapor with molten indium. Sulfur, a major impurity associated with the arsenic,could not be removed even by zone refining. Means were investigated for producing high purity arsenic. Electrical , optical and some physical and chemical properties of indium arsenide are presented.

Naval School of Aviation Medicine, Pensacola, Fla.
SURFACE DIFFUSION OF RADIOACTIVE MONOLAYERS AND A NEW METHOD OF DETECTING ACTIVE PATCHES AND SURFACE CRACKS, by Dietrich E. Beischer. 29 Dec 51, 21p. 14 refs. Proj. no. NM 001 059.16.07.
Order from LC mi$2.70, ph$4.80 PB 138 592

New York U., N. Y.
PERSISTENT INTERNAL POLARIZATION, by Harmut P. Kallmann. Progress rept. 6, v. 2 (Annual) 15 Oct 55-14 Oct 56 on Contract AF 18(600)1004. June 57, 82p. AFOSR TN-57-375; AD-132 449.
Order from LC mi$4.80, ph$13.80 PB 129 475

The polarization of single CdS crystals: Large PIP effects were found in single CdS crystals. These effects could be almost completely masked by the induction of photocurrents unless precautions were taken. Visible radiations as low as 10^{-2} f w/sq cm nullified the separation of charge almost immediately. IR wavelengths could be used to produce polarization to 2 or 3×10^{-8} coul/sq cm with a 200-v polarizing voltage. This polarization had a persistence of several days. Polarization process in anthracene: Anthracene layers of almost single-crystal structure were developed which were suitable for use in investigating the build-up and distribution of the polarization. The internal field distribution in these layers was measured, and information was obtained concerning how the change set free in anthracene is transferred to adjacent layers.

Westinghouse Electric Corp., East Pittsburgh, Pa.
GROWTH AND PREPARATION OF SINGLE CRYSTALS OF THE MAGNETIC, HIGH-ALUMINUM IRON ALLOYS, by R. C. Hall. Rept. on Solid State Research for Advancement of Electronic Materials, Contract AF 33(616)309. Nov 56, 18p. 7 refs. WADC Technical note 56-532; AD-110 663.
Order from LC mi$2.40, ph$3.30 PB 139 040

The method of growing large single crystals of the ferromagnetic, high-aluminum iron alloys from the melt is described in detail. From these single crystals, the preparation of circular disks and rectangular window frames by spark-cutting techniques is discussed.

Westinghouse Electric Corp., East Pittsburgh, Pa.
MAGNETIC ANISOTROPY OF ALUMINUM-IRON SINGLE CRYSTALS IN THE REGION OF 6 TO 30 ATOMIC PERCENT ALUMINUM, by R. C. Hall. Rept. on Solid State Research and Properties of Matter, Contract AF 33(616)309. May 57, 16p. 15 refs. WADC Technical note 57-269; AD-130 936.
Order from LC mi$2.40, ph$3.30 PB 139 041

Magnetic anisotropy was measured by means of torque curves. The anisotropy was higher than that of silicon iron in the region of 0 to 13 atomic percent alloy, became zero near 22 atomic-percent aluminum, was negative at higher compositions, and approached zero near 30 atomic-percent aluminum (for the ordered state). Disordering these alloys shifted the zero anisotropy composition to higher aluminum contents and decreased the anisotropy above this composition.

Westinghouse Electric Corp., East Pittsburgh, Pa.
THE MAGNETIC PROPERTIES OF SINGLE-CRYSTAL "PICTURE FRAMES" OF SEVERAL FERROMAGNETIC ALUMINUM-IRON ALLOYS, by R. C. Hall. Rept. on Contract AF 33(616)309. Oct 57, 19p. 13 refs. WADC Technical rept. 57-381; AD-142 246.
Order from LC mi$2.40, ph$3.30 PB 137 088

A magnetic anneal did not significantly benefit the magnetic properties of any crystal. Ordering of the crystals near the Fe_3Al composition indirectly affected some of the magnetic properties by changing the anisotropy of the alloys.

Westinghouse Electric Corp., East Pittsburgh, Pa.
MAGNETOSTRICTION OF ALUMINUM-IRON SINGLE CRYSTALS IN THE REGION OF 20 TO 30 ATOMIC PERCENT ALUMINUM, by R. C. Hall. Rept. on Solid State Research for Advancement of Electronic Materials, Contract AF 33(616)309. Nov 56, 18p. 16 refs. WADC Technical note 56-530; AD-110 661.
Order from LC mi$2.40, ph$3.30 PB 139 039

Saturation magnetostriction was measured on single crystals of the ferromagnetic aluminum-iron alloys in the composition range from 20 to 30 atomic percent aluminum. Magnetostriction constants, and saturation magnetostriction were calculated for single crystals and for polycrystalline material.

Westinghouse Electric Corp., East Pittsburgh, Pa.
SINGLE CRYSTAL HOLDER, by W. S. Byrnes and R. G. Crawford. Rept. on Solid State Research and Properties of Matter, Contracts AF 33(616)309 and AF 33(616)5555. Oct 58, 14p. 1 ref. WADC Technical note 58-339; AD-206 049.
Order from OTS $0.50 PB 151 602

An adjustable sample holder has been designed to facilitate the orientation and subsequent grinding of single crystals of ferromagnetic alloys. Orientation requires the preferred alignment of such samples with respect to the base of the holder by X-ray techniques; subsequent grinding operations from plane surfaces that have the desired crystal orientation. With the use of a Philips X-ray diffraction machine and a precision surface grinder, crystals can be ground to a desired orientation with an accuracy of ±30 minutes.

Theoretical Physics

California Inst. of Tech., Pasadena.
ION EXCHANGE KINETICS: A NONLINEAR DIFFUSION PROBLEM, by F. Helfferich and M. S. Plesset. Rept. on Contract Nonr-220(28). Sep 57, 26p. 23 refs. Engineering Div. rept. no. 85-7.
Order from LC mi$2.70, ph$4.80 PB 136 439

Ideal limiting laws are calculated for the kinetics of particle diffusion controlled ion exchange processes involving ions of different mobilities between spherical ion exchanger beads of uniform size and a well-stirred solution. The calculations are based on the nonlinear Nernst-Planck equations of ionic motion, which take into account the effect of the electric forces (diffusion potential) within the system.

Maryland U., College Park.
CONSTRUCTION OF THE DIRAC EQUATION CENTRAL POTENTIAL FROM PHASE SHIFTS AND BOUND STATES, by Francisco Prats. Doctoral thesis. Rept. on Contract AF 49(638)24. [1958] 118p. Technical rept. no. 112; AFOSR TN-58-632; AD-162 162.
Order from LC mi$6.00, ph$18.30 PB 136 399

Thermodynamics

Armour Research Foundation, Chicago, Ill.
MEASUREMENTS OF THERMAL PROPERTIES, by I. B. Fieldhouse, J. C. Hedge, and J. I. Lang. Rept. for 1 July 57 - 31 Mar 58 on G. E. ANP Materials, Contract AF 33(616)3701. Nov 58, 108p. 6 refs. WADC Technical rept. 58-274; AD-206 892.
Order from OTS $2.50 PB 151 583

The objective of this program was the measurement of the high temperature thermal properties of materials. The materials investigated were Stainless Steel type 316, Stainless Steel type 347, Hastelloy R-235, Aluminum Oxide, Niobium, Lithium Hydride and Synthetic Sapphire. The thermal conductivity, specific heat, and linear thermal expansion were measured from 100°F to 3000°F, or to the melting point of the material, whichever was lower. Both the experimental measurements and the results of the conversion of these measurements to the desired physical properties are given.

Atomic Energy Research Establishment (Gt. Brit.)
REVIEW OF TWO-PHASE HEAT TRANSFER (1935 - 1957), by J. G. Collier. May 58, 121p. 292 refs.
Order from BIS $2.99 AERE CE/R 2496

A review is presented of the published literature dealing with heat transfer to two phase gas-liquid mixtures flowing in vertical and horizontal tubes under natural or forced circulation. Both single component and two component two phase heat transfer is dealt with. From this analysis of the literature a general appraisal of the mechanisms of heat transfer is made. Special sections include those on the effects of agitation and surface on nucleate boiling. Recommendations for further work on the subject are put forward.

California Inst. of Tech., Pasadena.
THERMAL CONDUCTIVITY OF FLUIDS. NITRIC OXIDE, by G. N. Richter and B. H. Sage. Technical report on Project Squid, Contract N60ri-105(03). Aug 57, 22p. 14 refs. CIT-2-P.
Order from LC mi$2.70, ph$4.80 PB 136 224

California U., Berkeley.
ON THE DEVELOPMENT OF GASEOUS DETONATION. II. ANALYSIS OF WAVE INTERACTION PHENOMENA, by A. K. Oppenheim and R. A. Stern. Technical note DR-2 on Contract AF 49(638)166. July 58, 49p. 19 refs. AFOSR TN-58-384; AD-154 291.
Order from LC mi$3.30, ph$7.80 PB 136 257

Salient phenomena associated with transition from deflagration to detonation are the interactions between the flame and the shock fronts generated during the process. The scant records available in the literature on shock and flame propagation during the development of detonation are used as basis for the dynamic analysis of wave phenomena occurring during the process. It is demonstrated how, by this means, the observed wave interaction phenomena can be rationalized over the whole space-time domain of the process, and, in particular, how the thermodynamic state and the wave velocity in the regime into which the flame propagates can be determined with sufficient accuracy to deduce specific information on the reaction kinetics of a combustion front accelerating to detonation.

California U., Los Angeles.
ANALYTICAL STUDIES OF AIRCRAFT STRUCTURES EXPOSED TO TRANSIENT EXTERNAL HEATING. VOL. I: THERMAL RESPONSE OF A "THIN" PLATE UNDER THE INFLUENCE OF A CONSTANT TEMPERATURE EDGE, by Alphonso Ambrosio and Takao Ishimoto. Rept. on Effects of

Atomic Weapons on Aircraft Systems, Contract AF AF 33(616)293. May 54, 38p. 6 refs. WADC Technical rept. 54-579; AD-73 860.
Order from LC mi$3.00, ph$6.30 PB 138 657

This report is one of a series on analytical studies of aircraft structures exposed to transient external heating. The present study has been limited to skin regions between the underlying structures such as spars and stringers. By reducing the physical system to a simplified mathematical model, the conditions under which the temperature of the skin area is beyond the thermal influence of the spars and stringers were determined.

California U., Los Angeles.
ANALYTICAL STUDIES OF AIRCRAFT STRUCTURES EXPOSED TO TRANSIENT EXTERNAL HEATING. VOL. II: THERMAL RESPONSE OF A FINITE PLATE AND THE "THIN" PLATE CRITERION, by Alphonso Ambrosio and Takao Ishimoto. Rept. on Effects of Atomic Weapons on Aircraft Systems, Contract AF 33(616)293. Nov 54, 52p. 10 refs. WADC Technical rept. 54-579; AD-75 855.
Order from LC mi$3.60, ph$9.30 PB 138 658

This report is one of a series on analytical studies of aircraft structures exposed to transient external heating. In this study a criterion for predicting the maximum thickness of a "thin" skin that is thermally isolated from the supporting members is presented. The term "thin" states that the temperature difference across the skin is negligible compared to its maximum temperature rise. The criterion accounts for the effect of convective cooling and is established in terms of dimensionless parameters containing material properties and boundary conditions. The results are presented in graphical form.

Cryogenic Lab., Ohio State U. Research Foundation, Columbus.
THERMODYNAMIC PROPERTIES OF GASEOUS OXYGEN, by Herrick L. Johnston, Lydia Savedoff, and Jack Belzer. Technical rept. no. 4 on The Computation of Thermodynamic Properties of Gases from Their Spectra, Contract N6onr-225(12). 15 May 49, 19p. 18 refs. ATI-85 538.
Order from LC mi$2.40, ph$3.30 PB 137 302

Illinois Inst. of Tech., Chicago.
ACCOMODATION COEFFICIENT OF AIR CHROME SURFACES BY THE THREE PLATE METHOD, by Ralph E. Peck and John T. Madell. Technical rept. no. 2 on Contract DA 11-022-ORD-1249. June 56, 53p. 21 refs. AD-101 089.
Order from LC mi$3.60, ph$9.30 PB 136 414

The purpose of this study is to determine the feasibility of measuring the accommodation coefficients of a chrome surface for air by using the three plate method. The pressure range studied was 10 - 110 microns of mercury. The average temperature was 115°F. with the maximum temperature variance being ±7°F. This investigation includes a literature survey, a description of the laboratory equipment and experimental techniques, and a report of experimental data and correlation. The method of calculating the accommodation coefficient from apparent thermal conductivity is presented.

Illinois U. Engineering Experiment Station, Urbana.
DEVELOPMENT OF TEMPERATURE PROFILE FOR TURBULENT HEAT EXCHANGE IN A PIPE, by Thomas J. Hanratty and Robert E. Johnk. Technical rept. no. 4 on Contract DA 11-022-ORD-1707. Apr 57, 36p. 5 refs. AD-128 890.
Order from LC mi$3.00, ph$6.30 PB 136 415

The thermal diffusion process in an inhomogeneous turbulent field was examined by measuring the development of transverse temperature profiles in a thermal entry region in tube flow. In the initial phase of a more extensive program, data were obtained in a short section (L/D = 2.2) of electrically heated three-inch pipe. The equipment developed here will provide means of obtaining accurate temperature distribution data in a thermal entrance section long enough to allow complete development of temperature profiles.

Massachusetts Inst. of Tech., Cambridge.
LOCAL BOILING HEAT TRANSFER TO WATER AT LOW REYNOLDS' NUMBERS AND HIGH PRESSURES, by J. A. Clark and W. M. Rohsenow. Technical rept. no. 4 on Contract N5ori-078(27). 1 July 52, 59p. 5 refs. ATI-170 941.
Order from LC mi$3.60, ph$9.30 PB 138 651

National Bureau of Standards, Washington, D. C.
THERMAL CONDUCTIVITY AND HEAT CAPACITY OF MOLTEN MATERIALS. PART 5. THE THERMAL CONDUCTIVITY OF MOLYBENUM DISILICIDE FROM 300° to 800°C, by E. D. West, D.A. Ditmars, and D. C. Ginnings. Rept. on Molten Materials, Contract AF 33(616)52-10. Aug 54, 24p. 3 refs. WADC Technical rept. 53-201, pt. 5; AD-49 098.
Order from LC mi$2.70, ph$4.80 PB 138 009

A new apparatus is described for determining at high temperatures the thermal conductivities of liquids and solids having relatively high conductivities. The apparatus employs steady state longitudinal heat flow along a rod surrounded by a matched guard tube. Results on molybdenum disilicide are described.

Naval Ordnance Lab., White Oak, Md.
P-V-T AND THERMODYNAMIC DATA AT HIGH PRESSURES FOR MATERIALS OF INTEREST IN THE STUDY OF DETONATION AND SHOCK WAVES, by Donna Price. 14 Apr 50, 26p. 45 refs. NOLM 10912.
Order from LC mi$2.70, ph$4.80 PB 137 486

References to available P-V-T and thermodynamic data, at pressures above 300 atm., are given for gases and gas mixtures of interest in shock and detonation studies. Compressibility data for two solids, graphite and aluminum, are also included because of their relevance to current shock and detona-

tion studies. The data described are those available in the literature; they are presented in this summary to enhance their usefulness.

Research Inst., Temple U., Philadelphia, Pa.
ALUMINUM-SUN FURNACE, by Joseph B. Conway and Aristid V. Grosse. Technical rept. no. 2 on Contract N9onr-873(01). 1 July 52, 40p. ATI-166839.
Order from LC mi$3.00, ph$6.30 PB 137 382

The Aluminum-Sun Furnace is a new device in the field of high temperatures. It represents a simple, convenient and economical method of producing high temperatures over an extended area. It also serves as a source of high intensity thermal radiations.

Wave Propagation

Pennsylvania U., Philadelphia.
SHOCK WAVE PROPAGATION IN SOLIDS (A SURVEY OF THE LITERATURE), by J. R. Andersen and D. E. Nestler. Rept. on Project Frank, Contract NOrd-12772. 29 Jan 1953, 72p. 298 refs.
Order from LC mi$4.50, ph$12.30 PB 135 937

Abstracts of 12 Principal papers and bibliography of 298 references including the following subjects: **damping properties, crack propagation**, brittle lacquer, **elastic wave propagation**, explosive testing, general, Hertz contact theory, high velocity impact, Hopkinson pressure bar, mathematical techniques, notch effects, photoelasticity plasticity, plastic waves, projectiles, Rayleigh waves, Reflection, seismology, shock recording, strain gages temperature effects, and ultrasonics.

Pennsylvania State U., University Park.
SPHERICAL WAVES OF FINITE AMPLITUDE, by Donald T. Laird (Doctoral thesis) and Eugene Ackerman; James B. Randels and Hans L. Oestreicher (Aero Medical Lab.). Rept. on Theoretical Study of Acoustic Energy Generation, Propagation and Reception, Contract AF 33(616)2772. July 57, 133p. 68 refs. WADC Technical rept. 57-463; AD-130 949.
Order from LC mi$6.90, ph$21.30 PB 138 665

Large amplitude pressure waves in air are distorted during propagation due to the non-linear nature of the differential equations describing the motion of gases. The present report investigates the propagation, the distortion of wave shape and frequency spectrum, and the formation of shocks for spherical symmetrical waves, generated by a pulsating sphere.

Vermont U., Burlington.
WATER RIPPLE ANALOGUE: ELECTRO-MAGNETIC WAVE PROPAGATION, by Nelson L. Walbridge and Lloyd A. Woodward. Technical rept. no. 3 on Contract Nonr-597(01). Sep 57, 71p. AD-154 344.
Order from LC mi$4.50, ph$12.30 PB 137 256

In Technical Report #1 we gave the theory of the optics of ripples and described the method of measuring amplitudes of small ripples with accuracies approaching one percent or about 0.1 d.b. Various experiments were reported in which the theoretical radiation patterns from point sources, point arrays and shaped sources were successfully simulated. In Technical Report #2 we described the method of constructing a four point array which simulated, in one plane, the directed beam from a four dipole, double-H radiator. In this, the final report under the present contract, are included the simulation of the index of refraction with several applications, the simulation of the Luneberg lens with modifications and several experiments regarding the fundamental nature of wave motion.

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Air Force Office of Scientific Research, Washington, D. C.
ANNUAL REPORT NO. 2. AIR FORCE OFFICE OF SCIENTIFIC RESEARCH, 1957. July 58, 220p. AFOSR TR-58-71; AD-158 300.
Order from LC mi$9.60, ph$33.30 PB 135 564

It is a brief, general summary of the aims and results of the AFOSR exploratory research program during 1957. The second part is a more detailed listing of the technical accomplishments of our contractors, monitored by our Technical Divisions. Part III is an appendix, containing a detailed listing of AFOSR contracts, indexed by principal investigator and contractor, and lists of AFOSR consultants and advisors.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A MINIMUM "ONES" BINARY CODE FOR ENGLISH TEXT, by M. H. Weik. Sep 58, 9p. Technical note no. 1215.
Order from LC mi$1.80, ph$1.80 PB 136 990

A binary code for English text is proposed. Use of the code results in a minimization of punch wear and punch power by taking advantage of language redundancy.

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SURVEY OF THE FIELD OF MECHANICAL TRANSLATION OF LANGUAGES, by George W. Reitwiesner and Martin H. Weik. May 58, 63p. 170 refs. Memo. rept. no. 1147; AD-201 233.
Order from OTS $1.75 PB 151 147

A survey was made of the state-of-the-art mechanical translation of foreign languages by means of high speed electronic computers. This review describes the mechanical translation activities of 4 US government agencies, 6 commercial organizations, 12 educational institutions, and 4 foreign organizations.

The subject of mechanical translation of foreign languages by machine methods is described in terms of (1) methodology or language (i. e., grammatical rules, syntactical analysis, dictionaries, flow charts, and programming), and (2) machines or equipment (i. e., character sensing equipment, information storage devices, printing devices, and arithmetic or processing organs). The system performances described include the (1) All Purpose Electronic X-ray Computer (APEXC); (2) BESM (transliteration of Russian initials for high speed electronic computing machines); (3) Datatron; (4) IBM-650; (5) IBM-701; (6) IBM-704; (7) Johnniac; (8) Univac I; (9) Strela; (10) special purpose computer of the Univ of Washington; and (11) USAF mechanical translator Mk I. None of the organizations active in the field expects to have the capacity to translate an arbitrarily selected text in any one field of science for at least 6 to 12 mo; several are hoping to be able to perform at least crude translations within that time; and some do not expect to have working programs before at least a few years.

Naval Ordnance Test Station, China Lake, Calif.
IMPROVEMENT OF EFFICIENCY OF EXPERIMENT BY USE OF STATISTICAL DESIGN, by D. S. Villars. 30 Oct 56, 34p. 4 refs. NOTS-1621; NAVORD rept. 5377.
Order from LC mi$3.00, ph$6.30 PB 136 678

The lecture which this report reproduces is an elementary discussion of the subject for the benefit of those to whom it is new. After a short historical introduction, the steps of the procedure of variance analysis are summarized and illustrated by designs of increasing complexity: one-way classification, two-way classification, the Latin Square, the general factorial experiment, and the replication degeneracy design. Components of variance are shown for these different designs. Objective procedures for deciding the unique form of the correct analysis of variance and for deducing which are the correct significance tests are illustrated by a particular design of factorial experiment involving replication degeneracy. Finally, principles of design are summarized and a table is given showing how the different types of design correlate with these principles.

Naval Ordnance Test Station, China Lake, Calif.
LINEAR-BINARY TIMER: A HIGH RESOLUTION, INTEGRATING ELECTRONIC TIMER FOR PRECISION CAMERAS, by T. Parkin. 31 Aug 50, 34p. Technical memo. 304-50.
Order from LC mi$3.00, ph$6.30 PB 137 816

An all electronic method of generating a high accuracy, integrating time base is described, together with a method for indicating the time which is suitable for presentation on several types of cameras. A ten-stage linear counter followed by a fifteen-stage binary counter, together with gating and reset circuits and a five by five block of neon bulb indicators, make up this unit.

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. Apr 59.
Order from OTS $1.25, $10.00/year PB 151 337

Contents:

Articles:

Photography of the solar disk with radiation from the Lyman-alpha line of hydrogen, by J. D. Purcell, D. M. Packer and others

Surface mobility of dislocations and the Joffé effect, by W. H. Vaughan and J. W. Davisson

Vanguard vehicle telemetry data-reduction system, by I. J. Levy and W. B. Poland, Jr.

Scientific Program:

Astronomy and Astrophysics: A new solar spectrum in the extreme ultraviolet. Atmospheric radioactivity levels at Yokosuka, Japan, 1954-1958. Parachute-deliverable buoy-type automatic weather station

Chemistry: Stability and surface tension of Teflon dispersions in water. Oxides on the silver electrode. Structure of spurrite determined by computing the phase of the Fourier coefficients directly from measured x-ray intensities

Electricity: Steady state response of a synchronized LC oscillator to incremental reactance changes

Mathematics: Expressions predict the approximate displacement of fracture-inhibiting stiffeners riveted to structural material under load

Metallurgy and Ceramics: Deoxidation of molybdenum with selected reducing agents. Evidence of Brillouin zone overlap in dilute indium alloys. Influence of surface structure on high-temperature fatigue failures of Type-316 stainless steel in air and in vacuum. Modification of aluminum-silicon alloys. Laboratory results point to the possibility of complete inhibition of corrosive attack and pit formation in Navy boiler tubing.

Nuclear and Atomic Physics: Mean lifetime of the 3.56-Mev excited state of lithium-6 determined by nuclear resonance fluorescence measurements

Optics: Some characteristics of the eye affecting photometric measurements

Radio: Wave propagation in suspensions of spherical particles of different isotropic materials. Inductive effects in junction diodes. The Y- or junction-type circulator. Passive antenna arrays with linear polarization. Prototype model of an X-band microwave impedance recorder

Solid-State Physics: New thermoluminescent dosimeter permits detection of doses as low as 50 milliroentgens of cobalt-60 gamma radiation. Comparison of coloration of sodium chloride by ultraviolet light before and after high-energy irradiation

Sound: Sonar signal-processing research. Digital computer monitor

Supporting Techniques:

High-Purity Magnesia Ceramics

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U. S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number. These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

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Biology and Medicine

Isotope dilution as a measure of body composition in man, by Gilbert B. Forbes. Rochester University. School of Medicine and Dentistry, Rochester, N. Y. Aug 1957. Contract AT (30-1)-1827. M-6271. 23p. Order from LC. Mi $2.70, ph $4.80. AECU-3856

Physiological studies on congenital deformity in mice. Progress report and fourth renewal proposal. Report period: September 1, 1957-August 31, 1958. Renewal period: December 1, 1958-November 30, 1959, by Meredith N. Runner. Roscoe B. Jackson Memorial Lab. Bar Harbor, Me. Oct 1958. Contract AT(30-1)-1762. 11p. Order from LC. Mi $2.40, ph $3.30. AECU-3911

Metabolic effects of marked sodium restriction in hypertensive patients; comparison with two normotensive individuals, by Lewis K. Dahl and others. Brookhaven National Lab. Upton, N. Y. 1955. 31p. Order from LC. Mi $3.00, ph $6.30. BNL-2304

Aging effect of toxic and radiation stresses, by H. J. Curtis and K. L. Gebhard. Brookhaven National Lab. Upton, N. Y. 1957. 10p. Order from LC. Mi $2.40, ph $3.30. BNL-3800

Life expectancy in rats after single whole body exposures to slow neutrons or X-rays, by L. F. Nims and others. Brookhaven National Lab. Upton, N. Y. 1958. 4p. Order from LC. Mi $1.80, ph $1.80. BNL-3803

Concentration of radioisotopes in Columbia River whitefish in the vicinity of the Hanford Atomic Products Operation, by D. G. Watson and J. J. Davis. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Feb 1957. Decl. with deletions Oct 1958. Contract W-31-109-Eng-52. 133p. Order from LC. Mi $6.90, ph $21.30. HW-48523(Del.)

Effects of bicarbonate and other anions on the uptake of P32, Ca45, Fe59, Rb86, Sr90, Ru106, Cs137, and Ce144 by bean and barley plants, by J. A. Goss and E. M. Romney. Univ. of California. Atomic Energy Project, Los Angeles, Calif. Jun 1957. Contract AT-04-1-GEN-12. 23p. Order from LC. Mi $2.70, ph $4.80. UCLA-398

The development of leukemia and other neoplasms in mice receiving cell-free extracts from a high leukemia (AKR) strain, by Esther Fincher Hays and William S. Beck. Univ. of California. Atomic Energy Project, Los Angeles, Calif. Oct 1957. Contract AT-04-1-GEN-12. 19p. Order from LC. Mi $2.40, ph $3.30. UCLA-408

An ultracentrifugal method for the determination of serum lipoproteins, by Lugini Del Gatto and others. Univ. of California. Radiation Lab., Berkeley, Calif. Sep 1958. Contract W-7405-eng-48. 16p. Order from LC. Mi $2.40, ph $3.30. UCRL-8476

Recovery from a single dose of X-ray in old and young rats, by John B. Hursh and George W. Casarett. Rochester Univ. Atomic Energy Project, Rochester, N. Y. Jul 1958. Contract W-7405-eng-49. 21p. Order from LC. Mi $2.70, ph $4.80. UR-527

Studies on aerosols, by Lucien Dautrebande, M.D., Ph.D. Univ. of Rochester. Atomic Energy Project, Rochester, N. Y. Oct 1958. Contract W-7401-eng-49. 601p. Order from OTS. $7.00. UR-530

In vivo localization studies of I^{131} labeled anti-Murphy-Sturm lymphosarcoma antibodies, by Irving L. Spar and others. Rochester Univ. Atomic Energy Project, Rochester, N. Y. Sep 1958. Contract W-7401-eng-49. 24p. Order from LC. Mi $2.70, ph $4.80. UR-535

Localization of I^{131} labeled antibody to rat fibrin in a transplantable rat lymphosarcoma, by Irving L. Spar and others. Rochester Univ. Atomic Energy Project, Rochester, N. Y. Oct 1958. Contract W-7401-eng-49. 11p. Order from LC. Mi $2.40, ph $3.30. UR-536

Radionuclides in plankton near the Marshall Islands, 1956, by Frank G. Lowman. Univ. of Washington. Laboratory of Radiation Biology, Seattle, Wash. Feb 1958. Contract AT(45-1)540. 33p. Order from OTS. $1.00. UWFL-54

The occurrence of antimony-125, europium-155, iron-55, and other radionuclides in Rongelap Atoll soil, by Ralph F. Palumbo and Frank G. Lowman. Univ. of Washington. Applied Fisheries Laboratory, Seattle, Wash. Apr 1958. Contract AT(45-1)540. 26p. Order from OTS. $1.00. UWFL-56

Chemistry—General

Electrolysis cell for recombination studies, by R. S. Culver. Oak Ridge National Lab. Oak Ridge, Tenn. Sep 1958. Contract W-7405-eng-26. 7p. Order from LC. Mi $1.80, ph $1.80. CF-58-9-50

Status report on HF and UF_6 adsorption experiment, by Mack Tyner. Oak Ridge National Lab. Oak Ridge, Tenn. Sep 1958. Contract W-7405-eng-26. 16p. Order from LC. Mi $2.40, ph $3.30. CF-58-9-69

Four-tower water treatment test facility, by R. G. Murray and M. E. Tester. Goodyear Atomic Corp. Portsmouth, Ohio. Sep 1958. Contract AT(33-2)-1. 17p. Order from LC. Mi $2.40, ph $3.30. GAT-247

Nondestructive testing of MTR type fuel plates by X-ray absorption and fluorescence techniques, by M. C. Lambert. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Oct 1958. Contract W-31-1-9-Eng-52. 31p. Order from OTS. $1.00. HW-57941

Hydriding of zirconium and uranium in organic coolants, by V. H. Troutner. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Nov 1958. Contract W-31-109-Eng-52. 18p. Order from OTS. 75 cents. HW-58146

Vapor pressure measurements for the system: uranium hexafluoride–chlorine trifluoride, by W. C. Kuykendall. Oak Ridge Gaseous Diffusion Plant. Oak Ridge, Tenn. Nov 1956. Decl. Sep 1957. Contract W-7405-eng-26. 11p. Order from LC. Mi $2.40, ph $3.30. K-1298

Reactor fuels suspended in liquid metals. Part I. Laboratory study of voluminous uranium dioxide, by S. C. Furman. Knolls Atomic Power Lab. Schenectady, N. Y. Feb 1957. Decl. Oct 1958. Contract W-31-109-eng-52. 14p. Order from LC. Mi $2.40, ph $3.30. KAPL-1662

Significance of white corrosion products on zircaloy, A. B. Riedinger. Knolls Atomic Power Lab. Schenectady, N. Y. Sep 1958. Contract W-31-109-Eng-52. 9p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-ABR-6

Determination of silver, cadmium, indium, and tin in silver base alloys, by D. P. Stricos and J. T. Porter, II. Knolls Atomic Power Lab. Schenectady, N. Y. Jul 1958. Contract W-31-109-Eng-52. 13p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-DPS-1

The determination of residual chloride on a pipe surface after vapor phase degreasing, by E. L. Shirley. Knolls Atomic Power Lab. Schenectady, N. Y. Sep 1958. Contract W-31-109-Eng-52. 6p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-ELS-9

The polarographic determination of uranium in uranium-zirconium alloys and in uranium oxide-alumina ceramics, by J. T. Porter, II. Knolls Atomic Power Lab. Schenectady, N. Y. Aug 1958. Contract W-31-109-Eng-52. 17p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-JTP-3

Chemical analysis of iron, nickel, aluminum, silicon, and calcium in dysprosium metal, by R. F. Dufour. Knolls Atomic Power Lab. Schenectady, N. Y. Aug 1958. Contract W-31-109-Eng-52. 9p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-RFD-1

Chloride ion analyzer, by R. L. Seidel. Knolls Atomic Power Lab. Schenectady, N. Y. Sep 1958. Contract W-31-109-Eng-52. 35p. Order from LC. Mi $2.70, ph $4.80. KAPL-M-SMS-93

Tungsten interference in volumetric analysis of uranium, by R. F. Dufour and O. Articolo. Knolls Atomic Power Lab. Schenectady, N. Y. Aug 1958. Contract W-31-109-Eng-52. 9p. Order from LC. Mi $1.80, ph $1.80
KAPL-M-RFD-2

Determination of boron in uranium-zirconium fuel, by V. F. Consalvo. Knolls Atomic Power Lab. Schenectady, N. Y. Sep 1958. Contract W-31-109-Eng-52. 8p. Order from LC. Mi $1.80, ph $1.80. KAPL-M-VFC-4

The determination of boron carbide-zirconium clad with zircaloy, by Vivian F. Consalvo. Knolls Atomic Power Lab. Schenectady, N. Y. Oct 1958. Contract W-31-109-Eng-52. 8p. Order from LC. Mi $1.80, ph $1.80.
KAPL-M-VFC-5

Effect of plutonium on the fluorometric determination of uranium, by Karl S. Bergstresser. Los Alamos Scientific Lab. Los Alamos, N. Mex. Jul 1954. Decl. Jul 1956. Contract W-7405-eng-36. 24p. Order from LC. Mi $2.70, ph $4.80. LA-1707

The colorimetric determination of titanium in uranium, by A. L. Henicksman. Univ. of California. Los Alamos Scientific Lab., Los Alamos, N. Mex. Oct 1955. Contract W-7405-ENG-36. 14p. Order from OTS. 50 cents. LA-1967

Determination of particle size distribution and surface area by photometry, by D. R. King and J. B. Panowski. Los Alamos Scientific Lab. Los Alamos, N. Mex. May 1948. Decl. Nov 1958. 20p. Order from LC. Mi $2.70, ph $4.80.
LAMS-1267

Separation of small amounts of scandium from uranium, by Karl S. Bergstresser. Los Alamos Scientific Lab. Los Alamos, N. Mex. May 1954. Decl. Oct 1958. Contract W-7405-eng-36. 15p. Order from LC. Mi $2.40, ph $3.30.
LAMS-1674

Determination of hydrogen in lithium hydride, by Karl S. Bergstresser and Glenn R. Waterbury. Los Alamos Scientific Lab. Los Alamos, N. Mex. May 1954. Decl. Oct 1956. Contract W-7405-eng-36. 39p. Order from LC. Mi $3.60, ph $6.30. LAMS-1698

Separation of americium and promethium, by R. S. Pressly. Oak Ridge National Lab. Oak Ridge, Tenn. Mar 1957. Contract W-7405-eng-26. 4p. Order from LC. Mi $1.80, ph $1.80.
ORNL-2202

Isolation of carrier-free Mn^{54} and I^{125} from cyclotron targets, by H. T. Russell. Oak Ridge National Lab. Oak Ridge, Tenn. Jul 1957. Contract W-7405-eng-26. 3p. Order from LC. Mi $1.80, ph $1.80. ORNL-2330

Dissociation energies of gaseous oxides, by Leo Brewer. Univ. of California. Radiation Lab., Berkeley, Calif. Jul 1958. Contract W-7405-eng-48. 4p. Order from LC. Mi $1.80, ph $1.80. UCRL-8356

The total assay of high purity niobium metal by differential spectrophotometry, by R. O. Backer and others. Sep 1958. Contract AT 11-1-GEN-14. 10p. Order from OTS. 50 cents. WAPD-204

Chemistry—Radiation and Radiochemistry

Radiochemical instrumentation on the post irradiation corrosion loop, by D. G. Miller and W. C. Judd. Knolls Atomic Power Lab. Schenectady, N. Y. Jul 1958. Contract W-31-109-Eng-52. 14p. Order from LC. Mi $2.40, ph $3.30.
KAPL-M-DGM-1

Chemistry—Separation Processes for Plutonium and Uranium

Chemical engineering division summary report. July, August, September, 1958, by Stephen Lawroski and others. Argonne National Lab. Lemont, Ill. Dec 1958. Contract W-31-109-eng-38. 184p. Order from OTS. $3.00.
ANL-5924

Reduction and stabilization of plutonium nitrate in cation exchange feed and product solutions, by A. Brunstad and R. C. Smith. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. Sep 1957. Decl. Nov 1958. Contract W-31-109-Eng-52. 18p. Order from LC. Mi $2.40, ph $3.30. HW-52796

Studies of the rate of reaction between metallic uranium and solutions of chlorine trifluoride and hydrogen fluoride, by R. A. Gustison and E. J. Barber. Carbide and Carbon Chemicals Co. K-25 plant, Oak Ridge, Tenn. Oct 1952. Decl. Oct 1957. Contract W-7405-eng-26. 16p. Order from LC. Mi $2.40, ph $3.30.
K-945

Controlled Thermonuclear Processes

A fussion-fission reactor, by L. G. Barrett. Knolls Atomic Power Lab. Schenectady, N. Y. Jun 1957. Decl. Oct 1958. Contract W-31-109-Eng-52. 12p. Order from LC. Mi $2.40, ph $3.30. KAPL-M-LGB-14

A proposal for reducing impurities in stabilized pinched discharge, by Ralph H. Lovberg. Los Alamos Scientific Lab. Los Alamos, N. Mex. Jul 1957. Decl. Nov 1958. Contract W-7405-Eng-36. 13p. Order from LC. Mi $2.40, ph $3.30. LA-2148

Quarterly report covering the period October 1-December 31, 1957. Princeton Univ. Project Matterhorn, Princeton, N. J. 1957. Decl. Oct 1958. Contract AT(30-1)-1238. (PM-Q-1). 46p. Order from LC. Mi $3.30, ph $7.80. NYO-2192

Quarterly report covering the period January 1-March 31, 1958. Princeton Univ. Project Matterhorn, Princeton, N. J. 1958. Decl. Oct 1958. Contract AT(30-1)-1238. 46p. Order from LC. Mi $3.30, ph $7.80. NYO-2193

Quarterly report covering the period April 1-June 30, 1958. Princeton Univ. Project Matterhorn, Princeton, N. J. 1958. Decl. Aug 1958. Contract AT(30-1)-1238. 42p. Order from LC. Mi $3.00, ph $6.30. NYO-2194

Quarterly report covering the period July 1-September 30, 1958. Princeton Univ. Project Matterhorn, Princeton, N. J. 1958. Contract AT(30-1)-1238. (PM-Q-4). 41p. Order from LC. Mi $3.30, ph $7.80. NYO-2195

Electric fields in the stellarator, by Lyman Spitzer, Jr. Princeton Univ. Project Matterhorn, Princeton, N. J. Jun 1954. Decl. Oct 1958. 6p. Order from LC. Mi $1.80, ph $1.80. NYO-6359

A conceptual design of the model C stellarator, by W. R. Farber and others. Princeton Univ. Project Matterhorn, Princeton, N. J. Feb 1956. 568p. Order from OTS. $7.00. NYO-7309

Hydrogen discharges in the model B-1 stellarator, by W. Bernstein and others. Princeton Univ. Project Matterhorn, Princeton, N. J. Nov 1957. Decl. Oct 1958. PM-S-31. 47p. Order from LC. Mi $3.30, ph $7.80. NYO-7901

Resonance heating of ions in a strong magnetic field. (Individual particle treatment), by Andrew and Russell Kulsrud. Princeton Univ. Project Matterhorn, Princeton, N. J. Feb 1958. Decl. Oct 1958. Contract AT(30-1)-1238. (PM-S-32). 35p. Order from LC. Mi $2.70, ph $4.80. NYO-7902

Theory of cusped geometries. I. General survey, by Harold Grad. New York Univ. Atomic Energy Commission Computing and Applied Mathematics Center, New York, N. Y. Dec 1957. Decl. Nov 1958. Contract AT(30-1)-1480. 49p. Order from LC. Mi $3.30, ph $7.80. NYO-7969

Controlled thermonuclear conference held at Washington, D. C. February 3-5, 1958. United States Atomic Energy Commission. Technical Information Service Extension, Oak Ridge, Tenn. Oct 1958. 534p. Order from OTS. $4.75. TID-7558

Collapse-the shock heating of a plasma, by S. A. Colgate and R. E. Wright. Univ. of California. Radiation Lab., Livermore, Calif. Mar 1958. Contract W-7405-eng-48. 10p. Order from LC. Mi $1.80, ph $1.80. UCRL-5039

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Criticality Studies

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